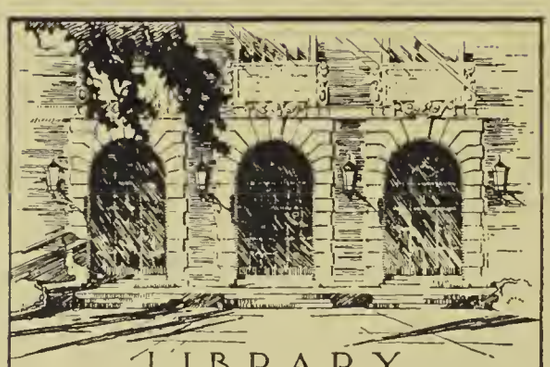

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REPORT

OF

TESTS ON THE STRENGTH OF STRUCTURAL MATERIAL

MADE AT THE

WATERTOWN ARSENAL, MASSACHUSETTS,

ON THE

400-TON TESTING MACHINE,

DURING THE

FISCAL YEAR ENDED JUNE 30, 1891.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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REMOTE STORAGE

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

The report of the commanding officer of the Watertown Arsenal of tests of materials for industrial and other purposes made at said arsenal during the fiscal year ended June 30, 1891.

MARCH 10, 1892.—Referred to the Committee on Manufactures and ordered to be printed.

WAR DEPARTMENT,
Washington City, February 19, 1892.

SIR: In compliance with the provisions of the act making appropriations for sundry civil expenses of the Government for the fiscal year ending June 30, 1886, and for other purposes (23 Statutes, page 502), I have the honor to transmit herewith the report of the commanding officer of the Watertown Arsenal, dated February 11, 1892, of tests of iron, steel, and other materials for industrial purposes, made with the United States testing machine during the fiscal year ended June 30, 1891.

Very respectfully,

S. B. ELKINS,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WATERTOWN ARSENAL,
Watertown, Mass., February 11, 1892.

SIR: I have the honor to submit the following report of tests of materials for industrial and other purposes made at this arsenal during the fiscal year ended June 30, 1891, in compliance with the requirements of the act of Congress appropriating funds for the testing machine.

The total number of specimens tested during the year was 3,207, of which number 390 were specimens of gun metal, 960 tests of other material for the Ordnance Department, 352 were tests for other Government departments, 613 industrial tests, and 892 private tests.

The report contains the results of tests made for the Ordnance Department and other departments of the Government; tests to determine the suitability of the material represented for ordnance construction, or such other purposes as the material may be intended for.

This comprises the tests for quality of material used in the current work of the Government.

Under the class of investigative work, tests have been continued upon internal strains in iron and steel cylinders, in forgings and in cold-rolled bars, and observations made upon the effects of annealing temperatures in relieving these strains.

A large number of tests have been made upon the series of steel-rail tests in the class of railroad material. The physical properties have been determined and chemical analyses made of a collection of rails representing a wide range in material, comprising specimens from brands of steel rails among the first introduced; also from rails of recent manufacture. Much valuable information has been developed by these tests.

An important feature was shown in the tests of certain rails which had been in service. It was found that a remarkable difference in toughness was displayed according to whether the rail was bent in a downward, the base being then under tension, or an upward direction, the head being under tension.

The downward bends were characterized by toughness, while an upward bend would cause a brittle fracture. This behavior was very prominent in a soft rail which had shown considerable flow of the metal of the head under the wheel pressures.

Work on riveted joints has been continued, supplying data upon the strength of joints intermediate between the more elementary and the complex types, which have been tested and included in earlier reports.

The retesting of material after a period of rest has furnished further information concerning the effect of overstraining upon the elastic properties of steel.

Experiments upon the endurance of rotating shafts, upon building stones, brick piers, the adhesion of nails in wood, the strength of cordage, are also included in this report.

The investigative tests which have been continued from the previous year are still in progress.

Some classes of tests inaugurated require intervals of rest before their completion, both the temporary and permanent effects or tendencies toward recuperation of the material after special treatment being investigated. This fact, and further the varied nature of the work of the testing machine, generally causes investigative tests to extend beyond the limits of one report, which contains the work done during the fiscal year.

The receipts and expenditures were as follows:

TESTING MACHINE, 1891.

Amount appropriated	$10,000.00
Received for private tests	1,119.06
	11,119.06
Amount expended for services and labor	8,788.39
Amount expended for light, power, tools, implements, and material for test	2,330.67
	11,119 06

Very respectfully, your obedient servant,

J. W. REILLY,
Major, Ord. Dept., U. S. A., Commanding.

The CHIEF OF ORDNANCE, U. S. ARMY,
Washington, D. C.

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3.2-INCH B. L. STEEL FIELD GUNS.

SPECIMENS FROM TUBES AND JACKETS.

TUBE NO. 77.

No. 4389.

Marks, $\overset{32\,R_{77}\,T}{B\,T_3\,O}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000250	.000150	.....	.....	
4,000	20,000	.000550	.000300	.....	.....	
6,000	30,000	.001050	.000500	.....	.....	
7,000	35,000	.001300	.000250	.000050	.000050	
8,000	40,000	.001650	.000350	.....	.....	
8,200	41,000	.001750	.000100	.....	.....	Elastic limit.
8,400	42,000	.009500	.007750	.007900	.007850	
8,600	43,000	.010850	.001350	.....	.....	
8,800	44,000	.011800	.000950	.....	.....	
9,000	45,000	.013100	.001300	.....	.....	
9,200	46,000	.014100	.001000	.....	.....	
16,620	83,100	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	83,100
Elastic limit per square inch of original section	do	41,000
Elongation per inch after rupture	inch	.2800
Elongation per inch under strain at elastic limit	do	.001750
Reduction in diameter at point of rupture	do	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		at middle of stem
Character of broken surface		silky, interspersed with fine granulation near the circumference
Elongation of inch sections		″.27*, ″.29*

No. 4399.

Marks, $^{32\ R_{77}\ T}_{B\ T_5\ O}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	* *Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000350	.000250	.....	.....	
4,000	20,000	.000600	.000250	.....	.....	
6,000	30,000	.001000	.000400	.....	.....	
7,000	35,000	.001100	.000100	0.	.....	
8,000	40,000	.001350	.000250	.....	.....	
8,400	42,000	.001400	.000050	0.	.....	
8,600	43,000	.001450	.000050	.....	.....	
8,800	44,000	.001500	.000050	.....	.....	
9,000	45,000	.001550	.000050	.....	.....	
9,200	46,000	.001600	.000050	.....	.....	
9,400	47,000	.001600	0.	.....	.....	
9,600	48,000	.001650	.000050	.....	.....	
9,800	49,000	.001650	0.	.....	.....	
10,000	50,000	.001750	.000100	.....	.....	Elastic limit.
10,200	51,000	.002050	.000300	.....	.....	
10,400	52,000	.002600	.000550	.....	.....	
10,600	53,000	.004400	.001800	.....	.....	
10,800	54,000	.006200	.001800	.....	.....	
11,000	55,000	.007050	.000850	.....	.....	
18,860	94,300	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,300
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001750
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.1 from the neck
Character of broken surface		silky
Elongation of inch sections		″.25*, ″.19

No. 4374.

Marks, $^{32\ R_{77}\ T}_{M\ T_1\ O}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000400	.000250	.....	.....	
4,000	20,000	.000650	.000250	.....	.....	
6,000	30,000	.000950	.000300	.....	.....	
7,000	35,000	.001100	.000150	0.	.....	
8,000	40,000	.001350	.000250	.....	.....	
8,200	41,000	.001400	.000050	.....	.....	Elastic limit.
8,400	42,000	.009800	.008400	.008150	.008150	
8,600	43,000	.010400	.000600	.....	.....	
8,800	44,000	.010900	.000500	.....	.....	
9,000	45,000	.011850	.000950	.....	.....	
9,200	46,000	.013550	.001700	.....	.....	
16,320	81,600	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	81,600
Elastic limit per square inch of original section	do...	41,000
Elongation per inch after rupture	inch..	.2450
Elongation per inch under strain at elastic limit	do...	.001400
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.05 from the neck
Character of broken surface		silky, 20 per cent interspersed with granular metal
Elongation of inch sections		″.19, ″.30*

Tube No. 83.

No. 4396.

Marks, $^{32\ R_{83}\ T}_{B\ T_1\ O}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000450	.000300	.....	.....	
4,000	20,000	.000850	.000400	.....	.....	
6,000	30,000	.001250	.000400	.....	.....	
7,000	35,000	.001450	.000200	0.	.....	
8,000	40,000	.001600	.000150	.....	.....	
8,400	42,000	.001700	.000100	.000150	.000150	Elastic limit.
8,600	43,000	.010450	.008750	.....	.....	
8,800	44,000	.010900	.000450	.....	.....	
9,000	45,000	.011400	.000500	.....	.....	
9,200	46,000	.012450	.001050	.....	.....	
9,400	47,000	.013600	.001150	.....	.....	
16,210	81,050	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	81,050
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		″.90 from the neck
Character of broken surface		granular; dull spot at the circumference
Elongation of inch sections		″.16, ″.26*

Tube No. 87.

No. 4400.

Marks, $^{32\ R_{87}\ T}_{B\ T_4\ O}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000350	.000250	.....	.....	
4,000	20,000	.000700	.000350	.....	.....	
6,000	30,000	.001050	.000350	.....	.....	
7,000	35,000	.001300	.000250	0.	.....	
8,000	40,000	.001500	.000200	.....	.....	
8,400	42,000	.001550	.000050	0.	.....	
8,600	43,000	.001550	0.	.....	.....	
8,800	44,000	.001600	.000050	.....	.....	
9,000	45,000	.001650	.000050	.....	.....	
9,200	46,000	.001700	.000050	.....	.....	
9,400	47,000	.001750	.000050	.....	.....	
9,600	48,000	.001800	.000050	.....	.....	Elastic limit.
9,800	49,000	.002000	.000200	.....	.....	
10,000	50,000	.002750	.000750	.....	.....	
10,200	51,000	.004500	.001750	.....	.....	
10,400	52,000	.006500	.002000	.....	.....	
10,600	53,000	.008400	.001900	.....	.....	
18,390	91,950	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	91,950
Elastic limit per square inch of original section	do	48,000
Elongation per inch after rupture	inch	.2300
Elongation per inch under strain at elastic limit	do	.001800
Reduction in diameter at point of rupture	do	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		1″.1 from the neck
Character of broken surface		silky, serrated
Elongation of inch sections		″.16, ″.30*

TUBE NO. 92.

No. 4398.

Marks, $\frac{32\ R_{92}\ T}{B\ T_1\ O}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000250	.000150	.....	.....	
4,000	20,000	.000550	.000300	.....	.....	
6,000	30,000	.000850	.000300	.....	.....	
7,000	35,000	.001050	.000200	.....	.....	
8,000	40,000	.001200	.000150	0.	.....	
8,400	42,000	.001300	.000100	0.	.....	
8,600	43,000	.001350	.000050	.....	.....	
8,800	44,000	.001350	0.	.....	.....	
9,000	45,000	.001400	.000050	.....	.....	
9,200	46,000	.001450	.000050	.....	.....	
9,400	47,000	.001500	.000050	.....	.....	
9,600	48,000	.001500	0.	.....	.....	
9,800	49,000	.001550	.000050	.....	.....	
10,000	50,000	.001600	.000050	.....	.....	Elastic limit.
10,200	51,000	.003250	.001650	.....	.....	
10,400	52,000	.004600	.001350	.....	.....	
10,600	53,000	.006000	.001400	.....	.....	
10,800	54,000	.006900	.000900	.....	.....	
11,000	55,000	.007950	.001050	.....	.....	
18,320	91,600	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,600
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.205
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		″.65 from the neck
Character of broken surface		silky
Elongation of inch sections		″.11, ″.30*

Tube No. 99.

No. 4402.

Marks, $\frac{32\ R_{99}\ T}{B\ T_1\ O}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	0.	
2,000	10,000	.000250	.000150	.....	.....	
4,000	20,000	.000600	.000350	.....	.....	
6,000	30,000	.000950	.000350	.....	.....	
7,000	35,000	.001150	.000200	0.	.....	
8,000	40,000	.001350	.000200	.....	.....	
8,400	42,000	.001400	.000050	0.	.....	
8,600	43,000	.001450	.000050	.....	.....	
8,800	44,000	.001500	.000050	.....	.....	
9,000	45,000	.001550	.000050	.....	.....	
9,200	46,000	.001600	.000050	.....	.....	
9,400	47,000	.001650	.000050	.....	.....	
9,600	48,000	.001650	0.	.....	.....	
9,800	49,000	.001700	.000050	.....	.....	
10,000	50,000	.001750	.000050	.....	.....	Elastic limit.
10,200	51,000	.010500	.008750	.....	.....	
10,400	52,000	.010900	.000400	.....	.....	
10,600	53,000	.011500	.000600	.....	.....	
10,800	54,000	.012600	.001100	.....	.....	
11,000	55,000	.014000	.001400	.....	.....	
17,130	85,650	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	85,650
Elastic limit per square inch of original section	do	50,000
Elongation per inch after rupture	inch	.2400
Elongation per inch under strain at elastic limit	do	.001750
Reduction in diameter at point of rupture	do	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		″.80 from the neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.35*

JACKET NO. 80.

No. 4391.

Marks, $^{32}_{T_1}\,R_{80}\,J\,O$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000450	.000350	.....	.....	
4,000	20,000	.000850	.000400	.....	.....	
6,000	30,000	.001150	.000300	.....	.....	
8,000	40,000	.001500	.000350	0.	.....	
9,200	46,000	.001600	.000100	0.	.....	
9,400	47,000	.001650	.000050	.....	.....	
9,600	48,000	.001700	.000050	.....	.....	
9,800	49,000	.001750	.000050	.....	.....	
10,000	50,000	.001800	.000050	.....	.....	
10,200	51,000	.001850	.000050	.....	.....	
10,400	52,000	.001900	.000050	.....	.....	
10,600	53,000	.001950	.000050	.....	.....	
10,800	54,000	.001950	0.	.....	.....	
11,000	55,000	.002000	.000050	.....	.....	Elastic limit.
11,200	56,000	.017100	.015100	.....	.....	
11,400	57,000	.018450	.001350	.....	.....	
11,600	58,000	.019750	.001300	.....	.....	
11,800	59,000	.021000	.001250	.....	.....	
12,000	60,000	.022000	.001000	.....	.....	
17,140	85,700	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	85,700
Elastic limit per square inch of original section	do	55,000
Elongation per inch after rupture	inch	.2000
Elongation per inch under strain at elastic limit	do	.002000
Reduction in diameter at point of rupture	do	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		″.55 from the neck
Character of broken surface		silky, serrated
Elongation of inch sections		″.12, ″.28*

Jacket No. 90.

No. 4390.

Marks, $\frac{\text{S C R}_{\text{W}} \text{ J}}{\text{T. C}}$
Diameter, [illegible].505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
20	1.00	0.	0.	0.	0.	Initial load.
1,000	5,000	.00010	.00010	0.	.....	
2,000	10,000	.00020	.00010	.....	.....	
4,000	20,000	.00050	.00030	.....	.....	
6,000	30,000	.00090	.00040	.....	.....	
8,000	40,000	.00130	.00040	0.	.....	
9,200	46,000	.00140	.00010	.00010	.00010	
9,400	47,000	.00150	.00010	.....	.....	
9,600	48,000	.00160	.00010	.....	.....	
9,800	49,000	.00170	.00010	.....	.....	
10,000	50,000	.00180	.00010	.....	.....	
10,200	51,000	.00190	0.	.....	.....	
10,400	52,000	.00200	.00010	.....	.....	
10,600	53,000	.00210	.00010	.....	.....	
10,800	54,000	.00220	0	.....	.....	Elastic limit.
11,000	55,000	.00230	.00010	.....	.....	
11,200	56,000	.00250	.00020	.....	.....	
11,400	57,000	.00280	.00030	.....	.....	
11,600	58,000	.00310	.00030	.....	.....	
11,800	59,000	.00350	.00040	.....	.....	
12,040	91,200	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,200
Elastic limit per square inch of original section	do...	54,000
Elongation per inch after rupture	inch..	.2250
Elongation per inch under strain at elastic limit	do...	.00170
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		1".1 from the neck
Character of broken surface		silky
Elongation of inch sections		1".30, 1".17

Jacket No. 95.

No. 4378.

Marks. $\frac{32\ R_{25}\ J}{T_1\ 6}$
Diameter. ″.505.
Sectional area. ″.20 square inch.
Gauged length. 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000450	.000300	.....	.....	
4,000	20,000	.000750	.000300	.....	.....	
6,000	30,000	.001100	.000350	.....	.....	
8,000	40,000	.001500	.000400	0.	.....	
9,200	46,000	.001650	.000150	0.	.....	
9,400	47,000	.001700	.000050	.....	.....	
9,600	48,000	.001700	0.	.....	.....	
9,800	49,000	.001750	.000050	.....	.....	
10,000	50,000	.001800	.000050	.....	.....	
10,200	51,000	.001900	.000100	.....	.....	
10,400	52,000	.001950	.000050	.....	.....	
10,600	53,000	.002000	.000050	.....	.....	
10,800	54,000	.002050	.000050	.....	.....	
11,000	55,000	.002100	.000050	.....	.....	
11,200	56,000	.002150	.000050	.....	.....	
11,400	57,000	.002200	.000050	.....	.....	
11,600	58,000	.002250	.000050	.....	.....	
11,800	59,000	.002300	.000050	.....	.....	Elastic limit.
12,000	60,000	.002450	.000150	.....	.....	
12,200	61,000	.002650	.000200	.....	.....	
12,400	62,000	.004200	.001550	.....	.....	
12,600	63,000	.005000	.000800	.....	.....	
12,800	64,000	.006750	.001750	.....	.....	
13,760	68,800	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	68,800
Elastic limit per square inch of original section	do	59,000
Elongation per inch after rupture	inch	.250
Elongation per inch under strain at elastic limit	do	.002950
Reduction in diameter at point of rupture	do	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		1″ from the neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		.350″, .14

JACKET No. 100.

No. 4397.

Marks, $^{32}\ ^{R_{100}\ J}_{T,\ O}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000200	.000200	0.	.....	
2,000	10,000	.000400	.000200	.....	.....	
4,000	20,000	.000900	.000500	.....	.....	
6,000	30,000	.001400	.000500	.....	.....	
8,000	40,000	.001850	.000450	.000200	.000200	
9,200	46,000	.002050	.000200	.000300	.000100	
9,400	47,000	.002100	.000050	.....	.....	
9,600	48,000	.002150	.000050	.....	.....	Elastic limit.
9,800	49,000	.016500	.014350	.....	.....	
10,000	50,000	.019500	.003000	.....	.....	
10,200	51,000	.020500	.001000	.....	.....	
10,406	52,000	.021250	.000750	.....	.....	
10,600	53,090	.022750	.001500	.....	.....	
16,270	81,350	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	81,350
Elastic limit per square inch of original section	do	48,000
Elongation per inch after rupture	inch	.1550
Elongation per inch under strain at elastic limit	do	.002150
Reduction in diameter at point of ruptnre	do	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.85 from the neck
Character of broken surface		granular, 60 per cent; silky serrated, 40 per cent
Elongation of inch sections		″.17*, ″.14

3.2-INCH B. L. STEEL FIELD GUNS.

Specific Gravity and Hardness of Tubes and Jackets.

[No tension tests of these specimens.]

Number of rifle.	Marks.	Specific gravity.	Hardness.
81	32 R_{81} T M R_3 M	7.8497	16.73
83	32 R_{83} T B R_3 M	7.8509	14.26
91	32 R_{91} T B R_3 M	7.8479	19.70
93	32 R_{93} T B R_5 M	7.8475	16.73
96	32 R_{96} T B R_5 M	7.8463	14.19
77	32 R_{77} J R_5 M	7.8409	14.69
83	32 R_{83} J R_6 M	7.8392	15.13
86	32 R_{86} J R_5 M	7.8401	17.26
92	32 R_{92} J R_3 M	7.8486	18.38
98	32 R_{98} J R_3 M	7.8385	19.18
99	32 R_{99} J R_4 M	7.8382	15 59

TABULATION OF SPECIMENS FROM 3.2-INCH B. L. STEEL FIELD GUNS.

[Stems 2 inches long, .505 inch diameter.]

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.
			Pounds.	*Pounds.*	*Per ct.*	*Per ct.*	
4389	Tube No. 77 ..	Outside.	41,000	83,100	28.0	37.1	Silky and fine granular.
4399	....do	...do	50,000	94,300	22.0	37.1	Silky.
4374	....do	...do	41,000	81,600	24.5	37.1	Silky and granular.
4396	Tube No. 83 ..	...do	42,000	81,050	21.0	30.7	Granular, dull spot.
4400	Tube No. 87 ..	...do	48,000	91,950	23.0	40.3	Silky serrated.
4398	Tube No. 92 ..	...do	50,000	91,600	20.5	40.3	Silky.
4402	Tube No. 99 ..	...do	50,000	85,650	24.0	43.3	Do.
4391	Jacket No. 80.	...do	55,000	85,700	20.0	37.1	Silky serrated.
4390	Jacket No. 90.	...do	54,000	91,200	23.5	49.1	Silky.
4378	Jacket No. 95.	...do	59,000	98,800	23.5	49.1	Silky, trace of granulation.
4397	Jacket No. 100.	...do	48,000	81,350	15.5	16.9	Granular, 60 per cent; silky serrated, 40 per cent.

3.2-INCH B. L. RIFLE (DRIGGS-SCHROEDER).

Specimen from Steel Tube.

No. 4317.

Marks, $\overset{32\ R\ D\ S_1\ T}{M\ T_5\ M}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000600	.000300	.....	.....	
6,000	30,000	.000900	.000300	.....	.....	
7,000	35,000	.001100	.000200	0.	.....	
8,000	40,000	.001350	.000250	.....	.....	
8,400	42,000	.001400	.000050	0.	.....	
8,600	43,000	.001450	.000050	.....	.....	
8,800	44,000	.001500	.000050	.....	.....	
9,000	45,000	.001500	0.	.....	.....	
9,200	46,000	.001550	.000050	.....	.....	
9,400	47,000	.001600	.000050	.....	.....	Elastic limit.
9,600	48,000	.001900	.000300	.....	.....	
9,800	49,000	.003250	.001350	.....	.....	
10,000	50,000	.009000	.005750	.....	.....	
10,200	51,000	.009700	.000700	.....	.....	
10,400	52,000	.010100	.000400	.....	.....	
10,600	53,000	.011250	.001150	.....	.....	
17,580	87,900	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	87,900
Elastic limit per square inch of original section	do	47,000
Elongation per inch after rupture	inch	.2400
Elongation per inch under strain at elastic limit	do	.001600
Reduction in diameter at point of rupture	do	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.27*, ″.21*

5-INCH B. L. STEEL SIEGE RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

Tube No. 4.

No. 4508.

Marks, $\frac{5\ R_4\ T}{M\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	.....	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001133	.000133	0.	.....	
10,000	40,000	.001400	.000267	.....	.....	
10,500	42,000	.001433	.000033	0.	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	
11,250	45,000	.001600	.000067	.....	.....	
11,500	46,000	.001667	.000067	.....	.....	Elastic limit.
11,750	47,000	.001833	.000166	.....	.....	
12,000	48,000	.007333	.005500	.....	.....	
12,250	49,000	.008400	.001067	.....	.....	
12,500	50,000	.009000	.000600	.....	.....	
12,750	51,000	.009667	.000667	.....	.....	
21.630	86,520	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,520
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.85 from neck
Character of broken surface		Silky, serrated
Elongation of inch sections		″.15, ″.34*, ″.18

Tube No. 7.

No. 4401.

Marks, $\frac{5\,R,\,T}{M\,T_2\,M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001067	.000400	.....	.....	
8,750	35,000	.001267	.000200	0.	.....	
10,000	40,000	.001500	.000233	.....	.....	
10,500	42,000	.001600	.000100	0.	.....	
10,750	43,000	.001600	0.	.....	.....	
11,000	44,000	.001633	.000033	.....	.....	
11,250	45,000	.001667	.000034	.....	.....	
11,500	46,000	.001733	.000066	.....	.....	
11.750	47,000	.001767	.000034	.....	.....	
12,000	48,000	.001800	.000033	.....	.....	
12,250	49,000	.001900	.000100	.....	.....	Elastic limit.
12,500	50,000	.002067	.000167	.....	.....	
12,750	51,000	.002667	.000600	.....	.....	
13,000	52,000	.004333	.001666	.....	.....	
13,250	53,000	.007167	.002834	.....	.....	
13,500	54,000	.008333	.001166	.....	.....	
22,780	91,120	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	91,120
Elastic limit per square inch of original section	do	49,000
Elongation per inch after rupture	inch	.1867
Elongation per inch under strain at elastic limit	do	.001900
Reduction in diameter at point of rupture	do	.094
Reduction in area after rupture, per cent of original section		30.6
Position of rupture		″.80 from the neck
Character of broken surface		granular, 70 per cent; silky serrated, 30 per cent
Elongation of inch sections		″.29,* ″.16, ″.11

TUBE NO. 10.

No. 4551.

Marks, $\frac{5\,R_{10}\,T}{B\,T_1\,M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000634	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001533	.000066	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	
11,750	47,000	.001667	.000067	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	Elastic limit.
12,250	49,000	.002167	.000467	.....	.....	
12,500	50,000	.003367	.001200	.....	.....	
12,750	51,000	.004333	.000966	.....	.....	
13,000	52,000	.005500	.001167	.....	.....	
13,260	53,000	.006333	.000833	.....	.....	
22,470	89,880	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	89,880
Elastic limit per square inch of original section	do	48,000
Elongation per inch after rupture	inch	.1133
Elongation per inch under strain at elastic limit	do	.001700
Reduction in diameter at point of rupture	do	.034
Reduction in area after rupture, per cent of original section		11.6
Position of rupture		″1.35 from neck.
Character of broken surface		granular; dull serrated spot at circumference
Elongation of inch sections		″.06, ″.13*, ″.13

JACKET NO. 3.

No. 4409.

Marks, $\frac{5\ R_3\ J}{M\ T^3\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000733	.000400	.....	.....	
7,500	30,000	.001067	.000334	.....	.....	
10,000	40,000	.001500	.000433	0.	.....	
11,500	46,000	.001700	.000200	.000033	.000033	
11,750	47,000	.001700	0.	.....	.....	
12,000	48,000	.001733	.000033	.....	.....	
12,250	49,000	.001767	.000034	.....	.....	
12,500	50,000	.001800	.000033	.....	.....	Elastic limit.
12,750	51,000	.001933	.000133	.....	.....	
13,000	52,000	.009333	.007400	.....	.....	
13,250	53,000	.009900	.000567	.....	.....	
13,500	54,000	.010600	.000700	.....	.....	
13,750	55,000	.011667	.001067	.....	.....	
22,890	91,560	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,560
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.8 from the neck
Character of broken surface		silky, 30 per cent being interspersed with fine granular metal
Elongation of inch sections		″.14, ″.37*, ″.15

JACKET NO. 7.

No. 4552.

Marks, $\frac{5\ R,\ J}{M\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000167	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
11,500	46,000	.001667	.000300	.000067	.000067	Elastic limit.
11,750	47,000	.001900	.000233	.....	.....	
12,000	48,000	.003167	.001467	.....	.....	
12,250	49,000	.003900	.000733	.....	.....	
12,500	50,000	.005000	.001100	.....	.....	
12,750	51,000	.005600	.000600	.....	.....	
22,640	90,560	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	90,560
Elastic limit per square inch of original section	do	46,000
Elongation per inch after rupture	inch	.1733
Elongation per inch under strain at elastic limit	do	.001667
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.6 from neck
Character of broken surface		silky
Elongation of inch sections		″.10, ″.32*, ″.10

5-INCH B. L. STEEL SIEGE RIFLES.

SPECIFIC GRAVITY AND HARDNESS OF JACKET NO. 4 AND TUBE NO. 7.

[No tension tests of these specimens.]

Number of rifle.	Marks.	Specific gravity.	Hardness.
7	5 R_7 T B R_3 M	7.8536	16.48
4	5R_4 J B R_4 M	7.8582	18.98

TABULATION OF SPECIMENS FROM 5-INCH B. L. STEEL SIEGE RIFLES.

[Stems 3 inches long, .564 inch diameter.]

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.
			Pounds.	*Pounds.*	*Per ct.*	*Per ct.*	
4508	Tube No. 4....	Middle..	46,000	86,520	22.3	41.9	Silky serrated.
4401	Tube No. 7....	...do	49,000	91,120	18.7	30.6	Granular, 70 per cent; silky serrated, 30 per cent.
4551	Tube No. 10...	...do	48,000	89,880	11.3	11.6	Granular, dull spot.
4409	Jacket No. 3 ..	...do	50,000	91,560	22.0	41.9	Silky and fine granular.
4552	Jacket No. 7 ..	...do	46,000	90,560	17.3	44.6	Silky.

7-INCH B. L. STEEL SIEGE HOWITZERS.

SPECIMENS FROM TUBES AND JACKETS.

TUBE NO. 3.

No. 4504.

Marks, $\frac{7\ H_3\ T}{B\ T_2\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001633	.000066	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001709	.000033	.....	.....	Elastic limit.
12,500	50,000	.002600	.000900	.....	.....	
12,750	51,000	.003200	.000600	.....	.....	
13,000	52,000	.006000	.002800	.....	.....	
13,250	53,000	.007067	.001067	.....	.....	
13,500	54,000	.008500	.001433	.....	.....	
21,460	85,840	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	85,840
Elastic limit per square inch of original section	do	49,000
Elongation per inch after rupture	inch	.2167
Elongation per inch under strain at elastic limit	do	.001700
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.7 from the neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.36*, ″.17

Tube No. 5.

No. 4507.

Marks, $\begin{smallmatrix} 7 & H_5 & T \\ B & T_2 & I \end{smallmatrix}$
Diameter, $''.564$.
Sectional area, .25 square inch.
Gauged length, $3''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001067	.000134	0.	.....	
10,000	40,000	.001267	.000200	.....	.....	
10,590	42,000	.001333	.000066	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45.000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	Elastic limit.
11,750	47,000	.001633	.000166	.....	.....	
12,000	48,000	.007000	.005367	.....	.....	
12,250	49,000	.008667	.001667	.....	.....	
12,500	50,000	.010000	.001333	.....	.....	
12,750	51,000	.010667	.000667	.....	.....	
20,260	81,040	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	81,040
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2467
Elongation per inch under strain at elastic limit	do...	.001467
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		$2''.2$ from neck
Character of broken surface		silky
Elongation of inch sections		$''.16$, $''.43^*$, $''.15$

TUBE NO. 9.

No. 4506.

Marks, $\frac{7\,H_9\,T}{B\,T_2\,I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	----------	
2,500	10,000	.000300	.000200	----------	----------	
5,000	20,000	.000633	.000333	----------	----------	
7,500	30,000	.000967	.000334	----------	----------	
8,750	35,000	.001133	.000166	0.	----------	
10.000	40,000	.001333	.000200	----------	----------	
10,500	42,000	.001400	.000067	.000033	.000033	
10,750	43,000	.001433	.000033	----------	----------	
11.000	44,000	.001500	.000067	----------	----------	
11,250	45,000	.001567	.000067	----------	----------	Elastic limit.
11,500	46,000	.001700	.000133	----------	----------	
16,750	47,000	.001900	.000200	----------	----------	
12,000	48,000	.002300	.000400	----------	----------	
12,250	49,000	.002967	.000667	----------	----------	
12,500	50,000	.004267	.001300	----------	----------	
21,620	86,480	----------	----------	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	86,480
Elastic limit per square inch of original section	do	45,000
Elongation per inch after rupture	inch	.2030
Elongation per inch under strain at elastic limit	do	.001567
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″ from neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.19, ″.30*

JACKET No. 1.

No. 4413.

Marks, $\frac{7H,\ J}{B\ T_2\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000433	.000300	.....	.....	
5,000	20,000	.000800	.000367	.....	.....	
7,500	30,000	.001100	.000300	.....	.....	
8,750	35,000	.001267	.000167	0.	.....	
10,000	40,000	.001467	.000200	.....	.....	
10,500	42,000	.001500	.000033	0.	.....	
10,750	43,000	.001567	.000067	.....	.....	Elastic limit.
11,000	44,000	.002533	.000966	.....	.....	
11,250	45,000	.004167	.001634	.....	.....	
11,500	46,000	.006333	.002166	.....	.....	
11,750	47,000	.007833	.001500	.....	.....	
12,000	48,000	.009000	.001167	.....	.....	
22,190	88,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,760
Elastic limit per square inch of original section	do...	43,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		1″ from the neck
Character of broken surface		silky
Elongation of inch sections		″.09, ″.17, ″.43*

No. 4410.

Marks, $\frac{7\,H,\,J}{M\,T_2\,I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,500	46,000	.001600	.000267	.000033	.000033	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001767	.000067	.....	.....	Elastic limit.
12.750	51,000	.001933	.000166	.....	.....	
13,000	52,000	.002133	.000200	.....	.....	
13,250	53,000	.002400	.000267	.....	.....	
13,500	54,000	.003200	.000800	.....	.....	
13,750	55,000	.003933	.000733	.....	.....	
24,110	96,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	96,440
Elastic limit per square inch of original section	do	50,000
Elongation per inch after rupture	inch	.2067
Elongation per inch under strain at elastic limit	do	.001767
Reduction in diameter at point of rupture	do	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″.23 from neck
Character of broken surface		granular; dull silky center
Elongation of inch sections		″.23*, ″.26*, ″.13

JACKET NO. 6.

No. 4403.

Marks, $\frac{7\,H_6\,J}{M\,T_2\,I}$
Diameter, ″.564.
Sectional area, .25-square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
10,000	40,000	.001267	.000334	0.	.....	
11,500	46,000	.001500	.000233	0.	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001567	.000034	.....	.....	
12,250	49,000	.001633	.000066	.....	.....	Elastic limit.
12,500	50,000	.002233	.000600	.....	.....	
12,750	51,000	.002767	.000534	.....	.....	
13,000	52,000	.004333	.001566	.....	.....	
13,250	53,000	.007000	.002667	.....	.....	
13,500	54,000	.008600	.001600	.....	.....	
23,210	92,840	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,840
Elastic limit per square inch of original section	do....	49,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″.95 from neck
Character of broken surface		silky
Elongation of inch sections		″.37*, ″.17, ″.11

JACKET NO. 8.

No. 4415.

Marks, $\frac{^{7}H_{8}J}{M\,T_{2}I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
10,000	40,000	.001267	.000334	0.	.....	
11,500	46,000	.001467	.000200	0.	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001567	.000067	.....	.....	
12,250	49,000	.001600	.000033	.....	.....	
12,500	50,000	.001633	.000033	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	
13,000	52,000	.001700	.000033	.....	.....	
13,250	53,000	.001733	.000033	.....	.....	
13,500	54,000	.001767	.000034	.....	.....	
13,750	55,000	.001833	.000066	.....	.....	
14,000	56,000	.001900	.000067	.....	.....	Elastic limit.
14,250	57,000	.002067	.000167	.....	.....	
14,500	58,000	.002633	.000566	.....	.....	
14,750	59,000	.003367	.000734	.....	.....	
15,000	60,000	.005267	.001900	.....	.....	
15,250	61,000	.005967	.000700	.....	.....	
24,970	99,880	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	99,880
Elastic limit per square inch of original section	do...	56,000
Elongation per inch after rupture	inch..	.1867
Elongation per inch under strain at elastic limit	do...	.001900
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		″.75 from the neck
Character of broken surface		silky, 90 per cent; granular, 10 per cent
Elongation of inch sections		″.32*, ″.13, ″.11

JACKET NO. 9.

No. 4414.

Marks, $\overset{7\ H,\ J}{B\ T,\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	.....	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000967	.000367	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
11,500	46,000	.001500	.000200	0.	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001567	.000034	.....	.....	
12,250	49,000	.001600	.000033	.....	.....	
12,500	50,000	.001633	.000033	.....	.....	
12,750	51,000	.001700	.000067	.....	.....	
13,000	52,000	.001733	.000033	.....	.....	
13,250	53,000	.001767	.000034	.....	.....	
13,500	54,000	.001800	.000033	.....	.....	
13,750	55,000	.001833	.000033	.....	.....	
14,000	56,000	.001900	.000067	.....	.....	
14,250	57,000	.001933	.000033	.....	.....	
14,500	58,000	.001967	.000034	.....	.....	
14,750	59,000	.002033	.000066	.....	.....	Elastic limit.
15,000	60,000	.002233	.000200	.....	.....	
15,250	61,000	.003667	.001434	.....	.....	
15,500	62,000	.005000	.001333	.....	.....	
15,750	63,000	.005667	.000667	.....	.....	
16,000	64,000	.006700	.001033	.....	.....	
25,440	101,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	101,760
Elastic limit per square inch of original section	do...	59.000
Elongation per inch after rupture	inch..	.1200
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.044
Reduction in area after rupture, per cent of original section		15.0
Position of rupture		″.70 from the neck
Character of broken surface		granular, an irregularly shaped silky spot near circumference
Elongation of inch sections		″.10, ″.12, ″.14*

7-INCH B. L. STEEL SIEGE HOWITZERS.

Specific Gravity and Hardness of Tubes and Jackets.

[No tension tests of these specimens.]

Number of howitzer.	Marks.	Specific gravity.	Hardness.
1	7 H_1 T B R_1 M	7.8526	15.83
3	7 H_3 T B R_1 M	7.8492	17.17
5	7 H_5 T B R_1 M	7.8476	15.13
9	7 H_9 T B R_1 M	7.8465	17.62
1	7 H_1 J B R_3 M	7.8468	18.68
5	7 H_5 J B R_5 M	7.8436	24.26
6	7 H_6 J B R_2 M	7.8513	18.48
9	7 H_9 J B R_1 M	7.8437	18.88

TABULATION OF SPECIMENS FROM 7-INCH B. L. STEEL SIEGE HOWITZERS.

[Stems 3 inches long, .564 inch diameter.]

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.
			Pounds.	*Pounds.*	*Per ct.*	*Per ct.*	
4504	Tube No. 3....	Inside ..	49,000	85,840	21.7	44.6	Silky.
4507	Tube No. 5....	...do	46,000	81,040	24.7	54.6	Do.
4506	Tube No. 9....	...do	45,000	86,480	20.3	44.6	Do.
4413	Jacket No. 1 ..	...do	43,000	88,760	23.0	54.6	Do.
4410	....do	...do ...	50,000	96,440	20.7	36.4	Granular, dull silky center.
4403	Jacket No. 6 ..	...do	49,000	92,840	21.7	49.7	Silky.
4415	Jacket No. 8 ..	...do	56,000	99,880	18.7	41.9	Silky, 90 per cent; granular, 10 per cent.
4414	Jacket No. 9 ..	Outside.	59,000	101,760	12.0	15.0	Granular, silky spot.

8-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS,

AND

SPECIFIC GRAVITY AND HARDNESS OF STEEL HOOPS.

TUBE NO. 2.

No. 4319.

Marks, $\frac{8\ R,\ T}{B\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000633	.000166	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001367	.000234	.....	.....	
10,500	42,000	.001433	.000066	.000033	.000033	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	Elastic limit.
11,250	45,000	.001667	.000134	.....	.....	
11,500	46,000	.001867	.000200	.....	.....	
11,750	47,000	.002400	.000533	.....	.....	
12,000	48,000	.003000	.000600	.....	.....	
12,250	49,000	.003633	.000633	.....	.....	
23,530	94,120	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,120
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″.23 from the neck
Character of broken surface		silky, 80 per cent; one side fine granular, 20 per cent
Elongation of inch sections		″.09, ″.21*, ″.23*

No. 901.

Marks, $\frac{8\ R_2\ T}{B\ T_{10}\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 3″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000067	.000067	----------	----------	
10,000	10,000	.000200	.000133	----------	----------	
15,000	15,000	.000367	.000167	----------	----------	
20,000	20,000	.000500	.000133	.000033	.000033	
25,000	25,000	.000667	.000167	----------	----------	
30,000	30,000	.000833	.000166	----------	----------	
35,000	35,000	.001000	.000167	----------	----------	
40,000	40,000	.001200	.000200	.000033	0.	
41,000	41,000	.001267	.000067	----------	----------	
42,000	42,000	.001300	.000033	----------	----------	
43,000	43,000	.001333	.000033	----------	----------	
44,000	44,000	.001367	.000034	----------	----------	
45,000	45,000	.001400	.000033	----------	----------	
46,000	46,000	.001433	.000033	----------	----------	Elastic limit.
47,000	47,000	.001600	.000167	----------	----------	
48,000	48,000	.002167	.000567	----------	----------	
49,000	49,000	.002533	.000366	----------	----------	
50,000	50,000	.003033	.000500	----------	----------	
51,000	51,000	.003700	.000667	----------	----------	
52,000	52,000	.004033	.000333	----------	----------	
54,000	54,000	.005667	.001634	----------	----------	
56,000	56,000	.007100	.001433	----------	----------	
58,000	58,000	.008367	.001267	----------	----------	
60,000	60,000	.010200	.001833	----------	----------	
62,000	62,000	.011367	.001167	----------	----------	
64,000	64,000	.013200	.001833	----------	----------	
66,000	66,000	.014300	.001100	----------	----------	
68,000	68,000	.015933	.001633	----------	----------	
70,000	70,000	.017567	.001634	----------	----------	
108,700	108,700	----------	----------	----------	----------	Ultimate strength.

Failed by triple flexure.

No. 4320.

Marks, $\frac{8\ R_2\ T}{M\ T_9\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000233	.000166	.....	.....	
5,000	20,000	.000600	.000367	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001267	.000167	.....	.....	
10,500	42,000	.001333	.000066	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	Elastic limit.
11,250	45,000	.004667	.003267	.....	.....	
11,500	46,000	.006000	.001333	.....	.....	
11,750	47,000	.007333	.001333	.....	.....	
12,000	48,000	.008033	.000700	.....	.....	
12,250	49,000	.008667	.000634	.....	.....	
20,980	83,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	83,920
Elastic limit per square inch of original section	do	44,000
Elongation per inch after rupture	inch	.2100
Elongation per inch under strain at elastic limit	do	.001400
Reduction in diameter at point of rupture	do	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.70 from the neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.39*, ″.12

Tube No. 5.

No. 893.

Marks, $\frac{8\ R_5\ T}{B\ T_{13}\ M}$
Length, 5″.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 3″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	0.	0.	Initial load.
2,500	5,000	.000100	.000100	.....	.....	
5,000	10,000	.000200	.000100	.....	.....	
7,500	15,000	.000300	.000100	.....	.....	
10,000	20,000	.000467	.000167	0.	.....	
12,500	25,000	.000600	.000133	.....	.....	
15,000	30,000	.000767	.000167	.....	.....	
17,500	35,000	.000967	.000200	.....	.....	
20,000	40,000	.001100	.000133	0.	.....	
22,500	45,000	.001233	.000133	.....	.....	Elastic limit.
23,000	46,000	.001433	.000200	.....	.....	
23,500	47,000	.002400	.000967	.....	.....	
24,000	48,000	.003400	.001000	.....	.....	
24,500	49,000	.004000	.000600	.....	.....	
25,000	50,000	.004733	.000733	.....	.....	
42,790	85,580	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

TUBE NO. 6.

No. 905.

Marks, $\frac{8\ R_6\ T}{B\ T_{10}\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000075	.000075	.....	.....	
10,000	10,000	.000200	.000125	.....	.....	
15,000	15,000	.000325	.000125	.....	.....	
20,000	20,000	.000475	.000150	.....	.....	
25,000	25,000	.000575	.000100	.....	.....	
30,000	30,000	.000700	.000125	0.	0.	
35,000	35,000	.000850	.000150	0.	.....	
40,000	40,000	.001000	.000150	.000025	.000025	
41,000	41,000	.001075	.000075	.....	.....	
42,000	42,000	.001125	.000050	.....	.....	
43,000	43,000	.001150	.000025	.....	.....	
44,000	44,000	.001175	.000025	.....	.....	
45,000	45,000	.001200	.000025	.....	.....	
46,000	46,000	.001225	.000025	.....	.....	
47,000	47,000	.001275	.000050	.....	.....	Elastic limit.
48,000	48,000	.001500	.000225	.....	.....	
49,000	49,000	.002550	.001050	.....	.....	
50,000	50,000	.003050	.000500	.001375	.001350	
52,000	52,000	.004250	.001200	.....	.....	
54,000	54,000	.005625	.001375	.....	.....	
56,000	56,000	.006950	.001325	.....	.....	
58,000	58,000	.008375	.001425	.....	.....	
60,000	60,000	.009700	.001325	.007375	.006000	
62,000	62,000	.010950	.001250	.....	.....	
64,000	64,000	.012500	.001550	.....	.....	
66,000	66,000	.014000	.001500	.....	.....	
68,000	68,000	.015675	.001675	.....	.....	
70,000	70,000	.017425	.001750	.014675	.007300	
107,800	107,800	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

TUBE NO. 7.

No. 4313.

Marks, $\frac{8\ R,\ T}{B\ T_8\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000267	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001633	.000066	.....	.....	
12,250	49,000	.001700	.000067	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	Elastic limit.
12,750	51,000	.009667	.007934	.....	.....	
13,000	52,000	.010600	.000933	.....	.....	
13,250	53,000	.010800	.000200	.....	.....	
13,500	54,000	.011833	.001033	.....	.....	
13,750	55,000	.012600	.000767	.....	.....	
22,920	91,680	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,680
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.084
Reduction in area after rupture, per cent of original section		27.6
Position of rupture		1″.9 from the neck
Character of broken surface		silky, 40 per cent; granular, 60 per cent
Elongation of inch sections		″.17, ″.30*, ″.14

No. 897.

Marks, $\frac{8\ R_7\ T}{B\ T_{10}\ M}$
Length, 5″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 3″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	0.	0.	Initial load.
4,000	5,000	.000067	.000067	.....	.....	
8,000	10,000	.000233	.000166	.....	.....	
12,000	15,000	.000367	.000134	.....	.....	
16,000	20,000	.000533	.000166	0.	.....	
20,000	25,000	.000700	.000167	.....	.....	
24,000	30,000	.000833	.000133	.....	.....	
28,000	35,000	.000967	.000134	.....	.....	
32,000	40,000	.001133	.000166	0.	.....	
36,000	45,000	.001333	.000200	.....	.....	
36,800	46,000	.001367	.000034	.....	.....	
37,600	47,000	.001400	.000033	.....	.....	
38,400	48,000	.001433	.000033	.....	.....	Elastic limit.
39,200	49,000	.007767	.006334	.....	.....	
40,000	50,000	.008100	.000333	.....	.....	
40,800	51,000	.008500	.000400	.....	.....	
41,600	52,000	.009000	.000500	.....	.....	
42,400	53,000	.009667	.000667	.....	.....	
43,200	54,000	.010333	.000666	.....	.....	
44,000	55,000	.011000	.000667	.....	.....	
77,320	96,650	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4314.

Marks, $\overset{8\ R_7\ T}{M\ T_6\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001800	.000067	.....	.....	Elastic limit.
13,250	53,000	.013333	.011533	.....	.....	
13,500	54,000	.014200	.000867	.....	.....	
13,750	55,000	.014933	.000733	.....	.....	
14,000	56,000	.015833	.000900	.....	.....	
14,250	57,000	.016833	.001000	.....	.....	
21,890	87,560	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,560
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.15 from the neck
Character of broken surface		silky
Elongation of inch sections		″.27*, ″.34*, ″.16

TUBE NO. 8.

No. 4282.

Marks, $\frac{8\ R_8\ T}{B\ T_1\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000967	.000367	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001400	.000100	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001700	.000033	.....	.....	
13,000	52,000	.001733	.000033	.....	.....	Elastic limit.
13,250	53,000	.003500	.001767	.....	.....	
13,500	54,000	.005333	.001833	.....	.....	
13,750	55,000	.006400	.001067	.....	.....	
14,250	57,000	.007667	.001267	.....	.....	
14,750	59,000	.008833	.001166	.....	.....	
15,250	61,000	.010233	.001400	.....	.....	
15,750	63,000	.012000	.001767	.....	.....	
16,250	65,000	.013667	.001667	.....	.....	
24,810	99,240	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	99,240
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″.15 from the neck
Character of broken surface		silky, slightly granular
Elongation of inch sections		″.25*, ″.16, ″.09

No. 898.

Marks, $\frac{8\ R_8\ T}{B\ T_4\ M}$
Length, 5″.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length 3″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	0.	0.	Initial load.
2,500	5,000	.000067	.000067	.....	.....	
5,000	10,000	.000233	.000166	.....	.....	
7,500	15,000	.000400	.000167	.....	.....	
10,000	20,000	.000533	.000133	0.	.....	
12,500	25,000	.000700	.000167	.....	.....	
15,000	30,000	.000867	.000167	.....	.....	
17,500	35,000	.001000	.000132	.....	.....	
20,000	40,000	.001167	.000167	0.	.....	
22,500	45,000	.001333	.000166	.....	.....	
23,000	46,000	.001367	.000034	.....	.....	
23,500	47,000	.001433	.000066	.....	.....	
24,000	48,000	.001500	.000067	.....	.....	
24,500	49,000	.001533	.000033	.....	.....	
25,000	50,000	.001600	.000067	.....	.....	
25,500	51,000	.001667	.000067	.....	.....	
26,000	52,000	.003000	.001333	.....	.....	Elastic limit.
26,500	53,000	.003667	.000667	.....	.....	
27,000	54,000	.004233	.000666	.....	.....	
27,500	55,000	.004700	.000467	.....	.....	
28,000	56,000	.005300	.000600	.....	.....	
28,500	57,000	.005800	.000500	.....	.....	
29,000	58,000	.006400	.000600	.....	.....	
29,500	59,000	.007000	.000600	.....	.....	
30,000	60,000	.007667	.000667	.....	.....	
45,270	90,540	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexture.

No. 4281.

Marks, $\overset{8\ R_8\ T}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000233	.000166	.....	.....	
5,000	20,000	.000567	.000334	.....	.....	
7,500	30,000	.000900	.000333	.....	.....	
8,750	35,000	.001067	.000167	0.	.....	
10,000	40,000	.001267	.000200	.....	.....	
10,500	42,000	.001300	.000033	0.	.....	
10,750	43,000	.001333	.000033	.....	.....	
11,000	44,000	.001367	.000034	.....	.....	
11,250	45,000	.001400	.000033	.....	.....	
11,500	46,000	.001433	.000033	.....	.....	
11,750	47,000	.001467	.000034	.....	.....	
12,000	48,000	.001533	.000066	.....	.....	
12,250	49,000	.001567	.000034	.....	.....	
12,500	50,000	.001633	.000066	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	
13,000	52,000	.001700	.000033	.....	.....	
13,250	53,000	.001733	.000033	.....	.....	
13,500	54,000	.001767	.000034	.....	.....	
13,750	55,000	.001800	.000033	.....	.....	Elastic limit.
14,000	56,000	.014000	.012200	.....	.....	
14,250	57,000	.014667	.000667	.....	.....	
14,500	58,000	.015400	.000733	.....	.....	
15,000	60,000	.017500	.002100	.....	.....	
15,500	62,000	.019500	.002000	.....	.....	
16,000	64,000	.021500	.002000	.....	.....	
16,500	66,000	.024167	.002667	.....	.....	
17,000	68,000	.026500	.002333	.....	.....	
22,720	90,880	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,880
Elastic limit per square inch of original section	do...	55,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.7 from the neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.33*, ″.13

Tube No. 9.

No. 906.

Marks, $\overset{8\,R_9\,T}{B\,T_7\,M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000075	.000075	.....	.....	
10,000	10,000	.000175	.000100	.....	.....	
15,000	15,000	.000275	.000100	.....	.....	
20,000	20,000	.000425	.000150	.....	.....	
25,000	25,000	.000575	.000150	.....	.....	
30,000	30,000	.000725	.000150	.....	.....	
35,000	35,000	.000875	.000150	.....	.....	
40,000	40,000	.001050	.000175	0.	.....	
41,000	41,000	.001100	.000050	.....	.....	
42,000	42,000	.001125	.000025	.....	.....	
43,000	43,000	.001175	.000050	.....	.....	
44,000	44,000	.001200	.000025	.....	.....	
45,000	45,000	.001250	.000050	.....	.....	
46,000	46,000	.001325	.000075	.....	.....	
47,000	47,000	.001375	.000050	.....	.....	Elastic limit.
48,000	48,000	.002625	.001250	.....	.....	
49,000	49,000	.003875	.001250	.....	.....	
50,000	50,000	.004675	.000800	.003000	.003000	
52,000	52,000	.005875	.001200	.....	.....	
54,000	54,000	.007250	.001375	.....	.....	
56,000	56,000	.008725	.001475	.....	.....	
58,000	58,000	.010150	.001425	.....	.....	
60,000	60,000	.011750	.001600	.009550	.006550	
62,000	62,000	.012750	.001000	.....	.....	
64,000	64,000	.014500	.001750	.....	.....	
66,000	66,000	.016125	.001625	.....	.....	
68,000	68,000	.017750	.001625	.....	.....	
70,000	70,000	.019175	.001425	.016625	.007075	
105,600	105,600	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

Tube No. 11.

No. 4355.

Marks, $\frac{8\ R_{II}\ T}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001533	.000100	.....	.....	
11,250	45,000	.001600	.000067	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	Elastic limit.
11,750	47,000	.004933	.003300	.....	.....	
12,000	48,000	.006767	.001834	.....	.....	
12,250	49,000	.007333	.000566	.....	.....	
12,500	50,000	.008267	.000934	.....	.....	
12,750	51,000	.008933	.000666	.....	.....	
22,270	89,080	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....pounds.. 89,080
Elastic limit per square inch of original section.....do... 46,000
Elongation per inch after rupture.....inch.. .1600
Elongation per inch under strain at elastic limit.....do... .001633
Reduction in diameter at point of rupture.....do... .074
Reduction in area after rupture, per cent of original section..... 24.6
Position of rupture.....″.95 from the neck.
Character of broken surface....granular, dull serrated spot at the circumference; opened cracks in the cylindrical surface of stem in vicinity of rupture.
Elongation of inch sections.....″.10, ″.15, ″.23*

No. 4377.

Marks, $\frac{8\ R_{II}\ T}{B\ T_4\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001533	.000066	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	Elastic limit.
11,750	47,000	.006000	.004400	.....	.....	
12,000	48,000	.008300	.002300	.....	.....	
12,250	49,000	.009000	.000700	.....	.....	
12,500	50,000	.009933	.000933	.....	.....	
12,750	51,000	.010567	.000634	.....	.....	
21,930	87,720	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....pounds.. 87,720
Elastic limit per square inch of original section.....do... 46,000
Elongation per inch after rupture.....inch.. .1667
Elongation per inch under strain at elastic limit.....do... .001600
Reduction in diameter at point of rupture.....do... .085
Reduction in area after rupture, per cent. of original section..... 27.6
Position of rupture .....″.4 from the neck
Character of broken surface....silky, serrated, 50 per cent; granular, 50 per cent; opened a crack in the stem ″.6 from place of rupture.
Elongation of inch sections .....″.24*, ″.14, ″.12

No. 914.

Marks, $\frac{8\ R_{11}\ T}{B\ T_{7}\ M}$
Length, 4″.975.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000050	.000050	.....	.....	
10,000	10,000	.000175	.000125	.....	.....	
15,000	15,000	.000300	.000125	.....	.....	
20,000	20,000	.000425	.000125	.....	.....	
25,000	25,000	.000550	.000125	.....	.....	
30,000	30,000	.000725	.000175	.000050	.000050	
35,000	35,000	.000925	.000200	.....	.....	
40,000	40,000	.001125	.000200	.000050	0.	
41,000	41,000	.001175	.000050	.....	.....	
42,000	42,000	.001200	.000025	.....	.....	
43,000	43,000	.001225	.000025	.....	.....	
44,000	44,000	.001275	.000050	.....	.....	Elastic limit.
45,000	45,000	.002750	.001475	.....	.....	
46,000	46,000	.007300	.004550	.....	.....	
47,000	47,000	.007925	.000625	.....	.....	
48,000	48,000	.008600	.000675	.....	.....	
49,000	49,000	.009200	.000600	.....	.....	
50,000	50,000	.009925	.000725	.008125	.008075	
52,000	52,000	.011425	.001500	.....	.....	
54,000	54,000	.013075	.001650	.....	.....	
56,000	56,000	.014500	.001425	.....	.....	
58,000	58,000	.016100	.001600	.....	.....	
60,000	60,000	.018000	.001900	.015825	.007700	
95,180	95,180	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 925.

Marks, $\frac{8\,R_{11}\,T}{B\,T_{10}\,M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100	.....	.....	
10,000	10,000	.000250	.000150	.....	.....	
15,000	15,000	.000425	.000175	.....	.....	
20,000	20,000	.000600	.000175	.....	.....	
25,000	25,000	.000775	.000175	.....	.....	
30,000	30,000	.000950	.000175	0.	.....	
35,000	35,000	.001125	.000175	.....	.....	
40,000	40,000	.001300	.000175	0.	.....	
41,000	41,000	.001350	.000050	.....	.....	Elastic limit.
42,000	42,000	.004875	.003525	.....	.....	
43,000	43,000	.006925	.002050	.....	.....	
44,000	44,000	.007425	.000500	.....	.....	
45,000	45,000	.007925	.000500	.....	.....	
46,000	46,000	.008675	.000750	.....	.....	
48,000	48,000	.010425	.001750	.....	.....	
50,000	50,000	.011875	.001450	.....	.....	
52,000	52,000	.013450	.001575	.....	.....	
54,000	54,000	.014950	.001500	.....	.....	
56,000	56,000	.016725	.001775	.....	.....	
58,000	58,000	.018800	.002075	.....	.....	
60,000	60,000	.020150	.001350	.....	.....	
62,000	62,000	.022275	.002125	.....	.....	
64,000	64,000	.024375	.002100	.....	.....	
66,000	66,000	.026750	.002375	.....	.....	
68,000	68,000	.028700	.001950	.....	.....	
70,000	70,000	.031150	.002450	.....	.....	
92,100	92,100	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4353.

Marks, $\frac{8\,R_{II}\,T}{M\,T_4\,M.}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	.....	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000900	.000267	.....	.....	
8,750	35,000	.001100	.000200	.....	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001333	.000033	.....	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001500	.000067	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001567	.000034	.....	.....	
12,250	49,000	.001600	.000033	.....	.....	
12,500	50,000	.001633	.000033	.....	.....	Elastic limit.
		.012667	.011034	.....	.....	Load fell.
12,750	51,000	.013667	.001000	.....	.....	
13,000	52,000	.014333	.000666	.....	.....	
13,250	53,000	.015267	.000934	.....	.....	
13,500	54,000	.016333	.001066	.....	.....	
13,750	55,000	.017233	.000900	.....	.....	
21,490	85,960	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,960
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2533
Elongation per inch under strain at elastic limit	do..	.001633
Reduction in diameter at point of rupture	do..	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.6 from the neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.39*, ″.22

No. 4354.

Marks, $\frac{8\ R_{11}\ T}{M\ T_5\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001467	.000067	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	Elastic limit.
12,500	50,000	.006000	.004300	.....	.....	
12,750	51,000	.009600	.003600	.....	.....	
13,000	52,000	.010333	.000733	.....	.....	
13,250	53,000	.011333	.001000	.....	.....	
13,500	54,000	.011933	.000600	.....	.....	
22,360	89,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	89,440
Elastic limit per square inch of original section	do	49,000
Elongation per inch after rupture	inch	.2000
Elongation per inch under strain at elastic limit	do	001700
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		″.55 from the neck
Character of broken surface		silky
Elongation of inch sections		″.36⅛, ″.12, ″.12

No. 4375.

Marks, $\frac{8\ R_{11}\ T}{M\ T_8\ O}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000933	.000300	.....	.....	
8,750	35,000	.001067	.000134	0.	.....	
10,000	40,000	.001300	.000233	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001500	.000067	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	Elastic limit.
12,250	49,000	.003333	.001700	.....	.....	
12,500	50,000	.005333	.002000	.....	.....	
12.750	51,000	.006667	.001334	.....	.....	
13,000	52,000	.007633	.000966	.....	.....	
13,250	53,000	.008367	.000734	.....	.....	
22,640	90,560	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	90,560
Elastic limit per square inch of original section	do	48,000
Elongation per inch after rupture	inch	0.1600
Elongation per inch under strain at elastic limit	do	001633
Reduction in diameter at point of rupture	do	.075
Reduction in area after rupture, per cent of original section		24.6
Position of rupture		1″.5 from the neck
Character of broken surface		silky, oblique, 50 per cent; granular, 50 per cent
Elongation of inch sections		″.11, ″.25*, ″.12

No. 4376.

Marks, $\frac{8\ R_{11}\ T}{M\ T_{12}\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001167	.000200	0.	.....	
10,000	40,000	.001300	.000133	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001433	.000066	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,230	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001633	.000066	.....	.....	Elastic limit.
12,000	48,000	.009667	.008034	.....	.....	
12,250	49,000	.010567	.000900	.....	.....	
12,500	50,000	.011333	.000766	.....	.....	
12,750	51,000	.012000	.000667	.....	.....	
13,000	52,000	.013000	.001000	.....	.....	
21,590	86,360	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	86,360
Elastic limit per square inch of original section	do	47,000
Elongation per inch after rupture	inch	.2067
Elongation per inch under strain at elastic limit	do	.001633
Reduction in diameter at point of rupture	do	.104
Reduction in area after rupture, per cent. of original section		33.5
Position of rupture		1″ from the neck
Character of broken surface		silky oblique
Elongation of inch sections		″.14, ″.20, ″.28*

TUBE NO. 12.

No. 915.

Marks, $\frac{8\ R_{12}\ T}{B\ T_4\ M}$
Length, 5″.009.
Diameter, 1″.103.
Sectional area, .955 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
790	830	0.	0.	0.	0.	Initial load.
3,950	4,140	.000050	.000050	.....	.....	
7,900	8,270	.000175	.000125	.....	.....	
11,850	12,410	.000275	.000100	.....	.....	
15,800	16,540	.000375	.000100	.....	.....	
19,750	20,680	.000600	.000225	.....	.....	
23,700	24,820	.000750	.000150	.000100	.000100	
27,650	28,950	.000850	.000100	.....	.....	
31,600	33,088	.001025	.000175	.000075	—.000025	
32,390	33,920	.001050	.000025	.....	.....	
33,180	34,740	.001075	.000025	.....	.....	
33,970	35,570	.001100	.000025	.....	.....	
34,760	36,400	.001125	.000025	.....	.....	
35,550	37,220	.001125	0.	.....	.....	
36,340	38,050	.001200	.000075	.....	.....	
37,130	38,880	.001225	.000025	.....	.....	
37,920	39,710	.001250	.000025	.....	.....	
38,710	40,530	.001300	.000050	.....	.....	
39,500	41,360	.001325	.000025	.000075	0.	
40,290	42,190	.001375	.000050	.....	.....	
41,080	43,020	.001400	.000025	.....	.....	
41,870	43,840	.001450	.000050	.....	.....	
42,660	44,670	.001500	.000050	.....	.....	
43,450	45,500	.001550	.000050	.....	.....	
44,240	46,330	.001625	.000075	.....	.....	Elastic limit.
45,030	47,150	.002175	.000550	.....	.....	
45,820	47,980	.004000	.001825	.....	.....	
46,610	48,810	.004625	.000625	.....	.....	
47,400	49,630	.005175	.000550	.003375	.003300	
48,980	51,290	.006375	.001200	.....	.....	
50,560	52,940	.007425	.001050	.....	.....	
52,140	54,600	.008750	.001325	.....	.....	
53,720	56,250	.009950	.001200	.....	.....	
55,300	57,910	.011300	.001350	.009000	.005625	
90,400	94,660	.....	.....	.....	.....	Ultimate strength.

Failed by double flexure.

TUBE NO. 13.

No. 4361.

Marks, $\frac{8\ R_{13}\ T}{B\ T_3\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,250	41,000	.001433	.000066	0.	.....	
10,500	42,000	.001467	.000034	.....	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001733	.000066	.....	.....	Elastic limit.
12,500	50,000	.001933	.000200	.....	.....	
12,750	51,000	.004267	.002334	.....	.....	
13,000	52,000	.005333	.001066	.....	.....	
13,250	53,000	.006000	.000667	.....	.....	
13,500	54,000	.007000	.001000	.....	.....	
23,560	94,240	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	94,240
Elastic limit per square inch of original section	do	49,000
Elongation per inch after rupture	inch	.1733
Elongation per inch under strain at elastic limit	do	.001733
Reduction in diameter at point of rupture	do	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1″.5 from the neck
Character of broken surface		granular; silky oblique at one side
Elongation of inch sections		″.12, ″.30*, ″.10

No. 4373.

Marks, $\overset{8}{B}\ \overset{R_{13}}{T_5}\ \overset{T}{M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001333	.000133	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001467	.000067	.....	.....	
11,000	44,000	.001500	.000033	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	Elastic limit.
11,500	46,000	.005600	.004067	.....	.....	
11,750	47,000	.006067	.000467	.....	.....	
12,000	48,000	.006833	.000766	.....	.....	
12,250	49,000	.007633	.000800	.....	.....	
12,500	50,000	.008500	.000867	.....	.....	
22,590	90,360	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,360
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent. of original section		41.9
Position of rupture		1″ from the neck
Character of broken surface		silky
Elongation of inch sections		″.29*, ″.19, ″.11

No. 916.

Marks, $\frac{8\ R_{13}\ T}{B\ T_{7}\ M}$
Length, 5″.
Diameter, 1″.105.
Sectional area, .959 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
959	1,000	0.	0.	0.	0.	Initial load.
4,795	5,000	.000100	.000100	.....	.....	
9,590	10,000	.000250	.000150	.....	.....	
14,385	15,000	.000400	.000150	.....	.....	
19,180	20,000	.000550	.000150	.....	.....	
23,975	25,000	.000700	.000150	.....	.....	
28,770	30,000	.000850	.000150	.000025	.000025	
33,565	35,000	.001000	.000150	.....	.....	
38,360	40,000	.001200	.000200	0.	—.000025	
39,319	41,000	.001250	.000050	.....	.....	
40,278	42,000	.001300	.000050	.....	.....	
41,237	43,000	.001325	.000025	.....	.....	
42,196	44,000	.001350	.000025	.....	.....	Elastic limit.
43,155	45,000	.001750	.000400	.....	.....	
44,114	46,000	.003450	.001700	.....	.....	
45,073	47,000	.004250	.000800	.....	.....	
46,032	48,000	.005000	.000750	.....	.....	
46,991	49,000	.005550	.000550	.....	.....	
47,950	50,000	.006400	.000850	.004500	.004500	
49,868	52,000	.007750	.001350	.....	.....	
51,786	54,000	.009175	.001425	.....	.....	
53,704	56,000	.010500	.001325	.....	.....	
55,622	58,000	.012000	.001500	.....	.....	
57,540	60,000	.013375	.001375	.011100	.006600	
59,458	62,000	.014950	.001575	.....	.....	
61,376	64,000	.016500	.001550	.....	.....	
63,294	66,000	.018500	.002000	.....	.....	
65,212	68,000	.020025	.001525	.....	.....	
67,130	70,000	.021725	.001700	.019000	.007900	
88,420	92,200	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4359.

Marks, $\frac{8\ R_{13}\ T}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001367	.000200	.....	.....	
10,500	42,000	.001400	.000033	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001667	0.	.....	.....	
12,750	51,000	.001700	.000033	.....	.....	
13,000	52,000	.001733	.000033	.....	.....	
13,250	53,000	.001800	.000067	.....	.....	
13,500	54,000	.001867	.000067	.....	.....	
13,750	55,000	.001900	.000033	.....	.....	Elastic limit.
14,000	56,000	.014000	.012100	.....	.....	
14,250	57,000	.014500	.000500	.....	.....	
14,500	58,000	.015333	.000833	.....	.....	
14,750	59,000	.016333	.001000	.....	.....	
15,000	60,000	.017500	.001167	.....	.....	
22,690	90,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,760
Elastic limit per square inch of original section	do...	55,000
Elongation per inch after rupture	inch..	.2030
Elongation per inch under strain at elastic limit	do...	.001903
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		″.80 from the neck
Character of broken surface		silky
Elongation of inch sections		″.14, ″.15, ″.32*

No. 4360.

Marks, $\frac{8\ R_{13}\ T}{M\ T_4\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000167	.000167	0.	.....	
2,500	10,000	.000333	.000166	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001233	.000200	.000033	.000033	
10,000	40,000	.001400	.000167	.....	.....	
10,500	42,000	.001467	.000067	.000033	0.	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001567	.000067	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	
12,250	49,000	.001733	.000033	.....	.....	
12,500	50,000	.001800	.000067	.....	.....	
12,750	51,000	.001867	.000067	.....	.....	Elastic limit.
13,000	52,000	.014600	.012733	.....	.....	
13,250	53,000	.014967	.000367	.....	.....	
13,500	54,000	.015600	.000633	.....	.....	
13,750	55,000	.016233	.000633	.....	.....	
14,000	56,000	.017233	.001000	.....	.....	
21,690	86,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	86,760
Elastic limit per square inch of original section	do	51,000
Elongation per inch after rupture	inch	.2233
Elongation per inch under strain at elastic limit	do	.001867
Reduction in diameter at point of rupture	do	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.4 from the neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.35*, ″.19

No. 4371.

Marks, $\frac{8\ R_{13}\ T}{M\ T_8\ I}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000967	.000367	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001400	0.	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001600	.000067	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	Elastic limit.
12,750	51,000	.013733	.012066	.....	.....	
13,000	52,000	.014500	.000767	.....	.....	
13,250	53,000	.015267	.000767	.....	.....	
13,500	54,000	.016267	.001000	.....	.....	
13,750	55,000	.017233	.000966	.....	.....	
21,210	84,840	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,840
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2633
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.175
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.9 from the neck
Character of broken surface		silky
Elongation of inch sections		″.17, ″.55*, ″.17

No. 4372.

Marks, $\frac{8\ R_{12}\ T}{M\ T_{11}\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001400	.000033	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	Elastic limit.
12,750	51,000	.015833	.014133	.....	.....	
13,000	52,000	.016700	.000867	.....	.....	
13,250	53,000	.017833	.001133	.....	.....	
13,500	54,000	.018900	.001067	.....	.....	
13,750	55,000	.019933	.001033	.....	.....	
20,720	82,880	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	82,880
Elastic limit per square inch of original section	do	50,000
Elongation per inch after rupture	inch	.2623
Elongation per inch under strain at elastic limit	do	.001700
Reduction in diameter at point of rupture	do	.175
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.5 from the neck
Character of broken surface		silky
Elongation of inch sections		″.19, ″.42*, ″.18

TUBE NO. 15.

No. 939.

Marks, $\frac{S\,R_{15}\,T}{B\,T_4\,M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100	.....	.....	
10,000	10,000	.000225	.000125	.....	.....	
15,000	15,000	.000350	.000125	.....	.....	
20,000	20,000	.000500	.000150	.....	.....	
25,000	25,000	.000650	.000150	.....	.....	
30,000	30,000	.000800	.000150	0.	.....	
35,000	35,000	.001000	.000200	.....	.....	
38,000	38,000	.001125	.000125	.....	.....	
39,000	39,000	.001150	.000025	.....	.....	
40,000	40,000	.001175	.000025	.000050	.000050	
41,000	41,000	.001225	.000050	.....	.....	Elastic limit.
42,000	42,000	.001300	.000075	.....	.....	
43,000	43,000	.001425	.000125	.....	.....	
44,000	44,000	.001950	.000525	.....	.....	
45,000	45,000	.003525	.001575	.002000	.001950	
46,000	46,000	.003950	.000425	.....	.....	
47,000	47,000	.004650	.000700	.....	.....	
48,000	48,000	.005500	.000850	.....	.....	
49,000	49,000	.006225	.000725	.....	.....	
50,000	50,000	.007000	.000775	.005225	.003225	
52,000	52,000	.008500	.001500	.....	.....	
54,000	54,000	.009950	.001450	.....	.....	
56,000	56,000	.011850	.001900	.....	.....	
58,000	58,000	.013325	.001475	.....	.....	
60,000	60,000	.015000	.001675	.012775	.007550	
62,000	62,000	.016675	.001675	.....	.....	
64,000	64,000	.018400	.001725	.....	.....	
66,000	66,000	.020625	.002225	.....	.....	
68,000	68,000	.002235	.001725	.....	.....	
70,000	70,000	.024450	.002100	.021875	.009100	
97,100	97,100	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

TUBE NO. 16.

No. 908.

Marks, $\frac{8\ R_{16}\ T}{B\ T_4\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000075	.000075	.....	.....	
10,000	10,000	.000225	.000150	.....	.....	
15,000	15,000	.000375	.000150	.....	.....	
20,000	20,000	.000550	.000175	.....	.....	
25,000	25,000	.000700	.000150	.....	.....	
30,000	30,000	.000875	.000175	0.	.....	
35,000	35,000	.001025	.000150	.....	.....	
40,000	40,000	.001200	.000175	0.	.....	
41,000	41,000	.001225	.000025	.....	.....	
42,000	42,000	.001250	.000025	.....	.....	
43,000	43,000	.001300	.000050	.....	.....	
44,000	44,000	.001350	.000050	.....	.....	
45,000	45,000	.001400	.000050	.....	.....	
46,000	46,000	.001450	.000050	.....	.....	
47,000	47,000	.001500	.000050	.....	.....	Elastic limit.
48,000	48,000	.001700	.000200	.....	.....	
49,000	49,000	.002025	.000325	.....	.....	
50,000	50,000	.002400	.000375	.000825	.000825	
52,000	52,000	.003875	.001475	.....	.....	
54,000	54,000	.005300	.001425	.....	.....	
56,000	56,000	.006850	.001550	.....	.....	
58,000	58,000	.008225	.001375	.....	.....	
60,000	60,000	.009675	.001450	.007425	.006600	
62,000	62,000	.010950	.001275	.....	.....	
64,000	64,000	.012500	.001550	.....	.....	
66,000	66,000	.014050	.001550	.....	.....	
68,000	68,000	.015400	.001350	.....	.....	
70,000	70,000	.017300	.001900	.014625	.007200	
105,600	105,600	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

Tube No. 17.

No. 4408.

Marks, $\overset{8\ R_{17}\ T}{B\ T_1\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001433	.000066	0.	.....	
10,750	43,000	.001500	.000067	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001600	.000067	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	
12,250	49,000	.001733	.000033	.....	.....	Elastic limit.
12,500	50,000	.005967	.004234	.....	.....	
12,750	51,000	.006600	.000633	.....	.....	
13,000	52,000	.007433	.000833	.....	.....	
13,250	53,000	.008167	.000734	.....	.....	
13,500	54,000	.009033	.000866	.....	.....	
22,860	91,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,440
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.15 from the neck.
Character of broken surface		granular, 50 per cent; silky, 50 per cent
Elongation of inch sections		″.29*, ″.22, ″.11

No. 933.

Marks, $\frac{8\ R_{17}\ T}{B\ T_4\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000075	.000075	.....	.....	
10,000	10,000	.000200	.000125	.....	.....	
15,000	15,000	.000325	.000125	.....	.....	
20,000	20,000	.000500	.000175	.....	.....	
25,000	25,000	.000650	.000150	.....	.....	
30,000	30,000	.000775	.000125	0.	.....	
35,000	35,000	.000925	.000150	.....	.....	
40,000	40,000	.001075	.000150	0.	.....	
41,000	41,000	.001125	.000050	.....	.....	
42,000	42,000	.001175	.000050	.....	.....	
43,000	43,000	.001225	.000050	.....	.....	
44,000	44,000	.001275	.000050	.....	.....	
45,000	45,000	.001325	.000050	.....	.....	
46,000	46,000	.001350	.000025	.....	.....	
47,000	47,000	.001425	.000075	.....	.....	
48,000	48,000	.001450	.000025	.....	.....	
49,000	49,000	.001500	.000050	.....	.....	Elastic limit.
50,000	50,000	.002450	.000950	.000975	.000975	
51,000	51,000	.004250	.001800	.....	.....	
52,000	52,000	.004925	.000675	.....	.....	
53,000	53,000	.005675	.000750	.....	.....	
54,000	54,000	.006350	.000675	.....	.....	
55,000	55,000	.007075	.000725	.005225	.004250	
56,000	56,000	.007675	.000600	.....	.....	
57,000	57,000	.008250	.000575	.....	.....	
58,000	58,000	.008775	.000525	.....	.....	
59,000	59,000	.009825	.001050	.....	.....	
60,000	60,000	.010550	.000725	.008400	.003175	
61,000	61,000	.011175	.000625	.....	.....	
62,000	62,000	.011800	.000625	.....	.....	
63,000	63,000	.012650	.000850	.....	.....	
64,000	64,000	.013325	.000675	.....	.....	
65,000	65,000	.014300	.000975	.011950	.003550	
66,000	66,000	.015000	.000700	.....	.....	
67,000	67,000	.015675	.000675	.....	.....	
68,000	68,000	.016375	.000700	.....	.....	
69,000	69,000	.017350	.000975	.....	.....	
70,000	70,000	.018250	.000900	.015725	.003775	
99,800	99,800	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4407.

Marks $\begin{matrix} {}^{8}R_{17}\,T \\ M\,T_{1}\,M \end{matrix}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000367	.000234	.....	.....	
5,000	20,000	.000733	.000366	.....	.....	
7,500	30,000	.001200	.000467	.....	.....	
8,750	35,000	.001367	.000167	0.	.....	
10,000	40,000	.001600	.000233	.....	.....	
10,500	42,000	.001633	.000033	.000067	.000067	
10,750	43,000	.001667	.000034	.....	.....	
11,000	44,000	.001700	.000033	.....	.....	
11,250	45,000	.001733	.000033	.....	.....	
11,500	46,000	.001767	.000034	.....	.....	
11,750	47,000	.001800	.000033	.....	.....	
12,000	48,000	.001867	.000067	.....	.....	
12,250	49,000	.001933	.000066	.....	.....	Elastic limit.
12,500	50,000	.002067	.000134	.....	.....	
12,750	51,000	.002367	.000300	.....	.....	
13,000	52,000	.004500	.002133	.....	.....	
13,250	53,000	.006900	.002400	.....	.....	
13,500	54,000	.008000	.001100	.....	.....	
23,420	93,680	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,680
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001933
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.6 from the neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.34*, ″.12

TUBE NO. 18.

No. 926.

Marks, $\frac{8\ R_{18}\ T}{B\ T_4\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000125	.000125	.....	.....	
10,000	10,000	.000275	.000150	.....	.....	
15,000	15,000	.000475	.000200	.....	.....	
20,000	20,000	.000625	.000150	.....	.....	
25,000	25,000	.000800	.000175	.....	.....	
30,000	30,000	.000975	.000175	0.	.....	
35,000	35,000	.001175	.000200	.....	.....	
40,000	40,000	.001350	.000175	.000050	.000050	
41,000	41,000	.001425	.000075	.....	.....	
42,000	42,000	.001475	.000050	.....	.....	
43,000	43,000	.001525	.000050	.....	.....	
44,000	44,000	.001550	.000025	.....	.....	
45,000	45,000	.001625	.000075	.....	.....	
46,000	46,000	.001675	.000050	.....	.....	Elastic limit.
47,000	47,000	.001775	.000100	.....	.....	
48,000	48,000	.002025	.000250	.....	.....	
49,000	49,000	.003875	.001850	.....	.....	
50,000	50,000	.005325	.001450	.....	.....	
52,000	52,000	.006750	.001425	.....	.....	
54,000	54,000	.008150	.001400	.....	.....	
56,000	56,000	.009700	.001550	.....	.....	
58,000	58,000	.011050	.001350	.....	.....	
60,000	60,000	.012500	.001450	.....	.....	
62,000	62,000	.014175	.001675	.....	.....	
64,000	64,000	.015800	.001625	.....	.....	
66,000	66,000	.017125	.001325	.....	.....	
68,000	68,000	.019125	.002000	.....	.....	
70 000	70,000	.021100	.001975	.....	.....	
101,300	101,300	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

TUBE NO. 19.

No. 940.

Marks, $\frac{8\ R_{19}\ T}{B\ T_4\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100	.....	.....	
10,000	10,000	.000225	.000125	.....	.....	
15,000	15,000	.000350	.000125	.....	.....	
20,000	20,000	.000475	.000125	.....	.....	
25,000	25,000	.000600	.000125	.....	.....	
30,000	30,000	.000750	.000150	0.	.....	
35,000	35,000	.000900	.000150	.....	.....	
40,000	40,000	.001050	.000150	0.	.....	
41,000	41,000	.001075	.000025	.....	.....	
42,000	42,000	.001100	.000025	.....	.....	
43,000	43,000	.001125	.000025	.....	.....	
44,000	44,000	.001175	.000050	.....	.....	
45,000	45,000	.001225	.000050	.....	.....	
46,000	46,000	.001275	.000050	.....	.....	
47,000	47,000	.001325	.000050	.....	.....	
48,000	48,000	.001375	.000050	.....	.....	
49,000	49,000	.001425	.000050	.....	.....	Elastic limit.
50,000	50,000	.001525	.000100	—.000100	—.000100	
51,000	51,000	.003775	.002250	.....	.....	
52,000	52,000	.004750	.000975	.....	.....	
53,000	53,000	.005325	.000575	.....	.....	
54,000	54,000	.005950	.000625	.....	.....	
56,000	56,000	.007250	.001300	.....	.....	
58,000	58,000	.008550	.001300	.....	.....	
60,000	60,000	.010125	.001575	.007825	.007925	
62,000	62,000	.011425	.001300	.....	.....	
64,000	64,000	.012750	.001325	.....	.....	
66,000	66,000	.014275	.001525	.....	.....	
68,000	68,000	.015925	.001650	.....	.....	
70,000	70,000	.017550	.001625	.014900	.007075	
96,200	96,200	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

TUBE NO. 20.

No. 4498.

Marks, $\frac{8\ R_{20}\ T}{B\ T_3\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001233	.000233	.000033	.000033	
10,000	40,000	.001400	.000167	.....	.....	
10,500	42,000	.001467	.000067	.000033	0.	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001567	.000067	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001733	.000066	.....	.....	Elastic limit.
12,250	49,000	.002000	.000267	.....	.....	
12,500	50,000	.004267	.002267	.....	.....	
12,750	51,000	.005900	.001633	.....	.....	
13,000	52,000	.006867	.000967	.....	.....	
13,250	63,000	.007500	.000633	.....	.....	
22,790	91,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,160
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″.15 from the neck
Character of broken surface		granular, 60 per cent; silky serrated, 40 per cent
Elongation of inch sections		″.29*, ″.19, ″.13

No. 942.

Marks, $\frac{8\ R_{20}\ T}{B\ T_4\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100	.....	.....	
10,000	10,000	.000225	.000125	.....	.....	
15,000	15,000	.000375	.000150	.....	.....	
20,000	20,000	.000525	.000150	.....	.....	
25,000	25,000	.000675	.000150	.....	.....	
30,000	30,000	.000850	.000175	0.	.....	
35,000	35,000	.000975	.000125	.....	.....	
40,000	40,000	.001175	.000200	.000025	.000025	
41,000	41,000	.001200	.000025	.....	.....	
42,000	42,000	.001225	.000025	.....	.....	
43,000	43.000	.001275	.000050	.....	.....	
44,000	44,000	.001325	.000050	.....	.....	
45,000	45,000	.001375	.000050	.000050	.000025	
46,000	46,000	.001450	.000075	.....	.....	
47,000	47,000	.001475	.000025	.....	.....	
48,000	48,000	.001500	.000025	.....	.....	
49,000	49,000	.001550	.000050	.....	.....	Elastic limit.
50,000	50.000	.001650	.000100	.000100	.000050	
51,000	51,000	.002125	.000475	.....	.....	
52,000	52,000	.003800	.001675	.....	.....	
53,000	53,000	.004875	.001075	.....	.....	
54,000	54.000	.005400	.000525	.....	.....	
55,000	55,000	.006500	.001100	.004500	.004400	
56,000	56.000	.007050	.000550	.....	.....	
58,000	58,000	.008575	.001525	.....	.....	
60,000	60,000	.010300	.001725	.008125	.003625	
62,000	62,000	.011500	.001200	.....	.....	
64,000	64,000	.013050	.001550	.....	.....	
66,000	66,000	.014875	.001825	.....	.....	
68,000	68,000	.016675	.001800	.....	.....	
70,000	70,000	.018450	.001775	.015750	.007625	
102,200	102,200	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4497.

Marks, $\frac{8\ R_{20}\ T}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001400	.000200	.....	.....	
10,500	42,000	.001433	.000033	0.	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001700	.000067	.....	.....	
12,250	49,000	.001733	.000033	.....	.....	Elastic limit.
12,500	50,000	.002167	.000434	.....	.....	
12,750	51,000	.003267	.001100	.....	.....	
13,000	52,000	.007233	.003966	.....	.....	
13,250	53,000	.007900	.000667	.....	.....	
13,500	54,000	.008600	.000700	.....	.....	
23,060	92,240	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	92,240
Elastic limit per square inch of original section	do	49,000
Elongation per inch after rupture	inch	.2067
Elongation per inch under strain at elastic limit	do	.001733
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″,2 from the neck
Character of broken surface		silky
Elongation of inch sections		″.29*, ″.21, ″.12

TUBE NO. 21.

No. 947.

Marks, $\frac{8\ R_{21}\ T}{B\ T_4\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000175	.000175	0.	.....	
10,000	10,000	.000350	.000175	.....	.....	
15,000	15,000	.000500	.000150	.....	.....	
20,000	20,000	.000650	.000150	.....	.....	
25,000	25,000	.000800	.000150	.....	.....	
30,000	30,000	.000975	.000175	0.	.....	
35,000	35,000	.001150	.000175	.....	.....	
40,000	40,000	.001300	.000150	0.	.....	
41,000	41,000	.001350	.000050	.....	.....	
42,000	42,000	.001375	.000025	.....	.....	
43,000	43,000	.001425	.000050	.....	.....	
44,000	44,000	.001475	.000050	.....	.....	
45,000	45,000	.001500	.000025	.....	.....	
46,000	46,000	.001550	.000050	.....	.....	
47,000	47,000	.001600	.000050	.....	.....	Elastic limit.
48,000	48,000	.001700	.000100	.....	.....	
49,000	49,000	.001850	.000150	.....	.....	
50,000	50,000	.002425	.000575	.000700	.000700	
51,000	51,000	.002750	.000325	.....	.....	
52,000	52,000	.003775	.001025	.....	.....	
53,000	53,000	.004550	.000775	.....	.....	
54,000	54,000	.005225	.000675	.....	.....	
56,000	56,000	.006975	.001750	.....	.....	
58,000	58,000	.008500	.001525	.....	.....	
60,000	60,000	.009975	.001475	.007700	.007000	
62,000	62,000	.011300	.001325	.....	.....	
64,000	64,000	.012750	.001450	.....	.....	
66,000	66,000	.014375	.001625	.....	.....	
68,000	68,000	.016075	.001700	.....	.....	
70,000	70,000	.017825	.001750	.015125	.007425	
96,810	96,810	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

Tube No. 23.

No. 4510.

Marks, $\frac{8\ R_{23}\ T}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001067	.000400	.....	.....	
8,750	35,000	.001233	.000166	0.	.....	
10,000	40,000	.001400	.000167	.....	.....	
10,500	42,000	.001433	.000033	0.	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001733	.000066	.....	.....	Elastic limit.
12,250	49,000	.005433	.003700	.....	.....	
12,500	50,000	.009000	.003567	.....	.....	
12,750	51,000	.009667	.000667	.....	.....	
13,000	52,000	.010667	.001000	.....	.....	
13,250	53,000	.011500	.000833	.....	.....	
22,030	88,120	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,120
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.6 from neck
Character of broken surface		silky
Elongation of inch sections		″.20, ″.33,* ″.13

No. 4509.

Marks, $\frac{8\ R_{23}\ T}{M\ T_1\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001100	.000100	0.	.....	
10,000	40,000	.001367	.000267	.....	.....	
10,500	42,000	.001400	.000033	.000033	.000033	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	Elastic limit.
13,000	52,000	.001900	.000167	.....	.....	
13,250	53,000	.003400	.001500	.....	.....	
13,500	54,000	.005000	.001600	.....	.....	
13,750	55,000	.005667	.000667	.....	.....	
14,000	56,000	.006667	.001000	.....	.....	
23,840	95,360	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,360
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″.5 from neck
Character of broken surface		granular, 55 per cent; silky, 45 per cent
Elongation of inch sections		″.11, ″.31*, ″.12

JACKET NO. 2.

No. 4347.

Marks, $\frac{8\ R_2\ J}{B\ T_9\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	----------	
2,500	10,000	.000300	.000167	----------	----------	
5,000	20,000	.000600	.000300	----------	----------	
7,500	30,000	.000933	.000333	----------	----------	
10,000	40,000	.001267	.000334	— .000033	— .000033	
11,000	44,000	.001533	.000266	+ .000033	+ .000066	Elastic limit.
11,250	45,000	.006000	.004467	----------	----------	
11,500	46,000	.007000	.001000	----------	----------	
11,750	47,000	.007500	.000500	----------	----------	
12,000	48,000	.008400	.000900	----------	----------	
12,250	49,000	.009000	.000600	----------	----------	
21,580	86,320	----------	----------	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	86,320
Elastic limit per square inch of original section	do	44,000
Elongation per inch after rupture	inch	.2167
Elongation per inch under strain at elastic limit	do	.001533
Reduction in diameter at point of rupture	do	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.14, ″.39*, ″.12

No. 928.

Marks, $\frac{8\ R_2\ J}{B\ T_{17}\ M}$
Length, 5″.
Diameter, 1″.126.
Sectional area, .996 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
996	1,000	0.	0.	0.	0.	Initial load.
4,980	5,000	.000125	.000125	.....	.....	
9,960	10,000	.000250	.000125	.....	.....	
14,940	15,000	.000400	.000150	.....	.....	
19,920	20,000	.000550	.000150	.....	.....	
24,900	25,000	.000750	.000200	.....	.....	
29,880	30,000	.000900	.000150	.0	.....	
34,860	35,000	.001075	.000175	.....	.....	
39,840	40,000	.001225	.000150	.0	.....	
44,820	45,000	.001400	.000175	.....	.....	
49,800	50,000	.001575	.000175	.....	.....	
50,796	51,000	.001625	.000050	.....	.....	Elastic limit.
51,792	52,000	.001825	.000200	.....	.....	
52,788	53,000	.003375	.001550	.....	.....	
53,784	54,000	.004300	.000925	.....	.....	
54,780	55,000	.004925	.000625	.....	.....	
55,776	56,000	.005575	.000650	.....	.....	
57,768	58,000	.006850	.001275	.....	.....	
59,760	60,000	.008200	.001350	.....	.....	
61,752	62,000	.009625	.001425	.....	.....	
63,744	64,000	.011000	.001375	.....	.....	
65,736	66,000	.012400	.001400	.....	.....	
67,728	68,000	.013625	.001225	.....	.....	
69,720	70,000	.015400	.001775	.....	.....	
107,900	108,330	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4346.

Marks, $\frac{8\ R_2\ J}{M\ T_{II}\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000167	.000167	0.	.....	
2,500	10,000	.000333	.000166	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
10,000	40,000	.001400	.000367	0.	.....	
11,000	44,000	.001533	.000133	0.	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	Elastic limit.
12,500	50,000	.012333	.010633	.....	.....	
12,750	51,000	.012833	.000500	.....	.....	
13,000	52,000	.013733	.000900	.....	.....	
13,250	53,000	.014667	.000934	.....	.....	
13,500	54,000	.015433	.000766	.....	.....	
21,530	86,120	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	86,120
Elastic limit per square inch of original section	do	49,000
Elongation per inch after rupture	inch	.2100
Elongation per inch under strain at elastic limit	do	.001700
Reduction in diameter at point of rupture	do	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″ from the neck
Character of broken surface		silky
Elongation of inch sections		″.30*, ″.19, ″.14

JACKET NO. 5.

No. 894.

Marks, $\frac{8\ R_5\ J}{B\ T_5\ M}$
Length, 5″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 3″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	0.	0.	Initial load.
4,000	5,000	.000100	.000100	.....	.....	
8,000	10,000	.000233	.000133	.....	.....	
12,000	15,000	.000367	.000134	.....	.....	
16,000	20,000	.000533	.000166	0.	.....	
20,000	25,000	.000700	.000167	.....	.....	
24,000	30,000	.000833	.000133	.....	.....	
28,000	35,000	.001033	.000200	.....	.....	
32,000	40,000	.001200	.000167	0.	.....	
36,000	45,000	.001367	.000167	.....	.....	
36,800	46,000	.001400	.000033	.....	.....	Elastic limit.
37,600	47,000	.001533	.000133	.....	.....	
38,400	48,000	.001767	.000234	.....	.....	
39,200	49,000	.002233	.000466	.....	.....	
40,000	50,000	.006500	.004267	.....	.....	
40,800	51,000	.006833	.000333	.....	.....	
41,600	52,000	.007267	.000434	.....	.....	
42,400	53,000	.008000	.000733	.....	.....	
43,200	54,000	.008600	.000600	.....	.....	
44,000	55,000	.009300	.000700	.....	.....	
77,840	97,300	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

JACKET NO. 7.

No. 895.

Marks, $\frac{8\ R_7\ J}{B\ T_9\ M}$
Length, 5″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 3″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	0.	0.	Initial load.
4,000	5,000	.000100	.000100	.....	.....	
8,000	10,000	.000267	.000167	.....	.....	
12,000	15,000	.000400	.000133	.....	.....	
16,000	20,000	.000567	.000167	0.	.....	
20,000	25,000	.000733	.000166	.....	.....	
24,000	30,000	.000867	.000134	.....	.....	
28,000	35,000	.001033	.000166	.....	.....	
32,000	40,000	.001200	.000167	0.	.....	
36,000	45,000	.001367	.000167	.....	.....	
36,800	46,000	.001433	.000066	.....	.....	
37,600	47,000	.001500	.000067	.....	.....	
38,400	48,000	.001533	.000033	.....	.....	Elastic limit.
39,200	49,000	.006500	.004967	.....	.....	
40,000	50,000	.007400	.000900	.....	.....	
40,800	51,000	.007833	.000433	.....	.....	
41,600	52,000	.008733	.000900	.....	.....	
42,400	53,000	.009233	.000500	.....	.....	
43,200	54,000	.009933	.000700	.....	.....	
44,000	55,000	.010767	.000834	.....	.....	
77,420	96,775	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

JACKET NO. 8.

No. 4316.

Marks, $\frac{8\ R_8\ J}{B\ T_6\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	.....	.....	
11,000	44,000	.001533	.000166	0.	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	
12,250	49,000	.001733	.000033	.....	.....	Elastic limit.
12,500	50,000	.011167	.009434	.....	.....	
12,750	51,000	.012333	.001166	.....	.....	
13,000	52,000	.013000	.000667	.....	.....	
13,250	53,000	.013567	.000567	.....	.....	
13,500	54,000	.014767	.001200	.....	.....	
21,790	87,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	87,160
Elastic limit per square inch of original section	do	49,000
Elongation per inch after rupture	inch	.2000
Elongation per inch under strain at elastic limit	do	.001733
Reduction in diameter at point of rupture	do	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.7 from the neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.34*, ″.14

No. 4315.

Marks, $\frac{8\ R_8\ J}{B\ T_7\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,000	44,000	.001533	.000200	.000033	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001733	.000066	.....	.....	Elastic limit.
12,250	49,000	.011000	.009267	.....	.....	
12,500	50,000	.011700	.000700	.....	.....	
12,750	51,000	.012333	.000633	.....	.....	
13,000	52,000	.013367	.001034	.....	.....	
13,250	53,000	.014333	.000966	.....	.....	
22,060	88,240	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,240
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section	do...	41.9
Position of rupture		1″.5 from the neck
Character of broken surface		silky
Elongation of inch sections		″.18, ″.23*, ″.13

No. 896.

Marks, $\begin{smallmatrix} 8\,R_8\,J \\ B\,T_9\,M \end{smallmatrix}$
Length, 5″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 3″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	0.	0.	Initial load.
4,000	5,000	.000100	.000100	.....	.....	
8,000	10,000	.000267	.000167	.....	.....	
12,000	15,000	.000400	.000133	.....	.....	
16,000	20,000	.000567	.000167	0.	.....	
20,000	25,000	.000733	.000166	.....	.....	
24,000	30,000	.000900	.000167	.....	.....	
28,000	35,000	.001067	.000167	.....	.....	
32,000	40,000	.001233	.000166	0.	.....	
36,000	45,000	.001433	.000200	.....	.....	
36,800	46,000	.001533	.000100	.....	.....	
37,600	47,000	.001600	.000067	.....	.....	Elastic limit.
38,400	48,000	.008100	.006500	.....	.....	
39,200	49,000	.008900	.000800	.....	.....	
40,000	50,000	.009400	.000500	.....	.....	
40,800	51,000	.010400	.001000	.....	.....	
41,600	52,000	.011100	.000700	.....	.....	
42,400	53,000	.011733	.000633	.....	.....	
43,200	54,000	.012500	.000767	.....	.....	
44,000	55,000	.013267	.000767	.....	.....	
74,880	93,600	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

JACKET NO. 9.

No. 909.

Marks, $\begin{matrix} 8\ R_9\ J \\ B\ T_9\ M \end{matrix}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100	.....	.....	
10,000	10,000	.000250	.000150	.....	.....	
15,000	15,000	.000375	.000125	.....	.....	
20,000	20,000	.000500	.000125	.....	.....	
25,000	25,000	.000675	.000175	.....	.....	
30,000	30,000	.000825	.000150	0.	.....	
35,000	35,000	.001000	.000175	.....	.....	
40,000	40,000	.001125	.000125	0.	.....	
41,000	41,000	.001150	.000025	.....	.....	
42,000	42,000	.001200	.000050	.....	.....	
43,000	43,000	.001250	.000050	.....	.....	
44,000	44,000	.001300	.000050	.....	.....	Elastic limit.
45,000	45,000	.002125	.000825	.....	.....	
46,000	46,000	.005500	.003375	.....	.....	
47,000	47,000	.006075	.000575	.....	.....	
48,000	48,000	.006750	.000675	.....	.....	
49,000	49,000	.007500	.000750	.....	.....	
50,000	50,000	.008000	.000500	.006250	.006250	
52,000	52,000	.009300	.001300	.....	.....	
54,000	54,000	.010750	.001450	.....	.....	
56,000	56,000	.012075	.001325	.....	.....	
58,000	58,000	.013550	.001475	.....	.....	
60,000	60,000	.015000	.001450	.012800	.006550	
62,000	62,000	.016575	.001575	.....	.....	
64,000	64,000	.018300	.001725	.....	.....	
66,000	66,000	.019800	.001500	.....	.....	
68,000	68,000	.021400	.001600	.....	.....	
70,000	70,000	.023325	.001925	.020750	.007950	
88,200	88,200	.....	.....	.....	.....	Ultimate strength.

Failed by double flexure.

JACKET NO. 10.

No. 917.

Marks, $^{8\ R_{10}\ J}_{B\ T_{13}\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100	.....	.....	
10,000	10,000	.000300	.000200	.....	.....	
15,000	15,000	.000450	.000150	.....	.....	
20,000	20,000	.000625	.000175	.....	.....	
25,000	25,000	.000775	.000150	.....	.....	
30,000	30,000	.000925	.000150	.000050	.000050	
35,000	35,000	.001125	.000200	.000050	0.	
40,000	40,000	.001275	.000150	0.	—.000050	
41,000	41,000	.001300	.000025	.....	.....	
42,000	42,000	.001325	.000025	.....	.....	
43,000	43,000	.001375	.000050	.....	.....	
44,000	44,000	.001400	.000025	.....	.....	
45,000	45,000	.001450	.000050	.....	.....	
46,000	46,000	.001500	.000050	.....	.....	
47,000	47,000	.001525	.000025	.....	.....	
48,000	48,000	.001600	.000075	.....	.....	Elastic limit.
49,000	49,000	.005125	.003525	.....	.....	
50,000	50,000	.005675	.000550	.003700	.003700	
52,000	52,000	.006800	.001125	.....	.....	
54,000	54,000	.008125	.001325	.....	.....	
56,000	56,000	.009450	.001325	.....	.....	
58,000	58,000	.010850	.001400	.....	.....	
60,000	60,000	.012325	.001475	.009825	.006125	
62,000	62,000	.013575	.001250	.....	.....	
64,000	64,000	.015200	.001625	.....	.....	
66,000	66,000	.016775	.001575	.....	.....	
68,000	68,000	.018375	.001600	.....	.....	
70,000	70,000	.019950	.001575	.017050	.007225	
103,100	103,100	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

JACKET NO. 11.

No. 4342.

Marks, $\frac{8\ R_{II}\ J}{B\ T_3\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
10,000	40,000	.001267	.000334	0.	.....	
11,000	44,000	.001367	.000100	0.	.....	
11,250	45,000	.001400	.000033	.....	.....	
11,500	46,000	.001433	.000033	.....	.....	
11,750	47,000	.001500	.000067	.....	.....	
12,000	48,000	.001567	.000067	.....	.....	
12,250	49,000	.001600	.000033	.....	.....	
12,500	50,000	.001633	.000033	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	
13,000	52,000	.001700	.000033	.....	.....	
13,250	53,000	.001733	.000033	.....	.....	
13,500	54,000	.001800 .012333	.000067 .010533	.....	.....	Elastic limit.
13,750	55,000	.012667	.000334	.....	.....	
14,000	56,000	.013367	.000700	.....	.....	
14,250	57,000	.014167	.000800	.....	.....	
14,500	58,000	.015033	.000866	.....	.....	
14,750	59,000	.016267	.001234	.....	.....	
22,790	91,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,160
Elastic limit per square inch of original section	do...	54,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.155
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		″.80 from the neck
Character of broken surface		silky
Elongation of inch sections		″.33*, ″.15, ″.13

No. 902.

Marks, $\begin{matrix} 8\ R_{11}\ J \\ B\ T_5\ M \end{matrix}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 3″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100	----------	----------	
10,000	10,000	.000167	.000067	----------	----------	
15,000	15,000	.000300	.000133	----------	----------	
20,000	20,000	.000467	.000167	0.	----------	
25,000	25,000	.000700	.000233	----------	----------	
30,000	30,000	.000867	.000167	----------	----------	
35,000	35,000	.001033	.000166	----------	----------	
40,000	40,000	.001200	.000167	.000033	.000033	
41,000	41,000	.001233	.000033	----------	----------	
42,000	42,000	.001267	.000034	----------	----------	
43,000	43,000	.001300	.000033	----------	----------	
44,000	44,000	.001333	.000033	----------	----------	
45,000	45,000	.001367	.000034	----------	----------	
46,000	46,000	.001400	.000033	----------	----------	
47,000	47,000	.001467	.000067	----------	----------	
48,000	48,000	.001533	.000066	----------	----------	
49,000	49,000	.001600	.000067	----------	----------	
50,000	50,000	.001700	.000100	.000100	.000067	Elastic limit.
51,000	51,000	.004800	.003100	----------	----------	
52,000	52,000	.011467	.006667	----------	----------	
53,000	53,000	.011600	.000133	----------	----------	
54,000	54,000	.012433	.000833	----------	----------	
56,000	56,000	.013867	.001434	----------	----------	
58,000	58,000	.015200	.001333	----------	----------	
60,000	60,000	.017000	.001800	----------	----------	
103,600	103,600	----------	----------	----------	----------	Ultimate strength.

Failed by triple flexure.

No. 4340.

Marks, $\frac{8\ R_{II}\ J}{M\ T_3\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Succcssive permanent set.	Remarks.
Total.	Per square inch,					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000567	.000300	.....	.....	
7,500	30,000	.000900	.000333	.....	.....	
10,000	40,000	.001233	.000333	0.	.....	
11,000	44,000	.001333	.000100	0.	.....	
11,250	45,000	.001367	.000034	.....	.....	
11,500	46,000	.001400	.000033	.....	.....	
11,750	47,000	.001433	.000033	.....	.....	
12,000	48,000	.001467	.000034	.....	.....	
12,250	49,000	.001533	.000066	.....	.....	
12,500	50,000	.001600	.000067	.....	.....	
12,750	51,000	.001633	.000033	.....	.....	
13,000	52,000	.001667	.000034	.....	.....	Elastic limit.
13,250	53,000	.004567	.002900	.....	.....	
13,500	54,000	.005667	.001100	.....	.....	
13,750	55,000	.006167	.000500	.....	.....	
14,000	56,000	.006900	.000733	.....	.....	
14,250	57,000	.007600	.000700	.....	.....	
24,420	97,680	.....	.....	.....	.....	Tensile strength.

General summary

Tensile strength per square inch of original section	pounds	97,680
Elastic limit per square inch of original section	do	52,000
Elongation per inch after rupture	inch	.1967
Elongation per inch under strain at elastic limit	do	.001667
Reduction in diameter at point of rupture	do	.135
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.25 from the neck
Character of broken surface		silky
Elongation of inch sections		″.11, ″.27*, ″.21

No. 4341.

Marks, $\frac{8\ R_{II}\ J}{M\ T_6\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
10,000	40,000	.001267	.000334	0.	.....	
11,000	44,000	.001367	.000100	0.	.....	
11,250	45,000	.001400	.000033	.....	.....	
11,500	46,000	.001433	.000033	.....	.....	
11,750	47,000	.001467	.000034	.....	.....	
12,000	48,000	.001533	.000066	.....	.....	
12,250	49,000	.001600	.000067	.....	.....	
12,500	50,000	.001633	.000033	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	Elastic limit.
13,000	52,000	.002067	.000400	.....	.....	
13,250	53,000	.002433	.000366	.....	.....	
13,500	54,000	.004333	.001900	.....	.....	
13,750	55,000	.006067	.001734	.....	.....	
14,000	56,000	.006667	.000600	.....	.....	
24,470	97,880	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	97,880
Elastic limit per square inch of original section	do	51,000
Elongation per inch after rupture	inch	.1967
Elongation per inch under strain at elastic limit	do	.001667
Reduction in diameter at point of rupture	do	.135
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		″.55 from the neck
Character of broken surface		silky
Elongation of inch sections		″.31*, ″.13, ″.15

JACKET NO. 12.

No. 910.

Marks, $\frac{8\ R_{12}\ J}{B\ T_9\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000075	.000075	.....	.....	
10,000	10,000	.000175	.000100	.....	.....	
15,000	15,000	.000300	.000125	.....	.....	
20,000	20,000	.000475	.000175	.....	.....	
25,000	25,000	.000625	.000150	.....	.....	
30,000	30,000	.000775	.000150	0.	.....	
35,000	35,000	.000950	.000175	.....	.....	
40,000	40,000	.001125	.000175	0.	.....	
41,000	41,000	.001150	.000025	.....	.....	
42,000	42,000	.001175	.000025	.....	.....	
43,000	43,000	.001200	.000025	.....	.....	
44,000	44,000	.001225	.000025	.....	.....	
45,000	45,000	.001250	.000025	.....	.....	
46,000	46,000	.001300	.000050	.....	.....	
47,000	47,000	.001325	.000025	.....	.....	
48,000	48,000	.001350	.000025	.....	.....	
49,000	49,000	.001375	.000025	.....	.....	
50,000	50,000	.001400	.000025	—.000075	—.000075	
51,000	51,000	.001450	.000050	.....	.....	
52,000	52,000	.001500	.000050	.....	.....	Elastic limit.
53,000	53,000	.001750	.000250	.....	.....	
54,000	54,000	.002225	.000475	.....	.....	
55,000	55,000	.002750	.000525	.....	.....	
56,000	56,000	.003425	.000675	.....	.....	
57,000	57,000	.003950	.000525	.....	.....	
58,000	58,000	.004575	.000625	.....	.....	
59,000	59,000	.005000	.000425	.....	.....	
60,000	60,000	.005450	.000450	.003625	.003700	
62,000	62,000	.006825	.001375	.....	.....	
64,000	64,000	.008200	.001375	.....	.....	
66,000	66,000	.009675	.001475	.....	.....	
68,000	68,000	.010925	.001250	.....	.....	
70,000	70,000	.012200	.001275	.009550	.005925	
94,200	94,200	.....	.....	.....	.....	Ultimate strength.

Failed by double flexure.

JACKET NO. 13.

No. 907.

Marks, $\frac{8\ R_{13}\ J}{B\ T_5\ M}$
Length, 5″.
Diameter, 1.″128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000050	.000050	.....	.....	
10,000	10,000	.000150	.000100	.....	.....	
15,000	15,000	.000275	.000125	.....	.....	
20,000	20,000	.000425	.000150	.....	.....	
25,000	25,000	.000575	.000150	.....	.....	
30,000	30,000	.000750	.000175	0.	.....	
35,000	35,000	.000925	.000175	.....	.....	
40,000	40,000	.001050	.000125	0.	.....	
41,000	41,000	.001075	.000025	.....	.....	
42,000	42,000	.001125	.000050	.....	.....	
43,000	43,000	.001150	.000025	.....	.....	
44,000	44,000	.001175	.000025	.....	.....	
45,000	45,000	.001200	.000025	.....	.....	
46,000	46,000	.001250	.000050	.....	.....	
47,000	47,000	.001275	.000025	.....	.....	
48,000	48,000	.001300	.000025	.....	.....	
49,000	49,000	.001325	.000025	.....	.....	
50,000	50,000	.001350	.000025	0.	.....	Elastic limit.
51,000	51,000	.001475	.000125	.....	.....	
52,000	52,000	.004625	.003150	.....	.....	
53,000	53,000	.005450	.000825	.....	.....	
54,000	54,000	.006125	.000675	.....	.....	
55,000	55,000	.006675	.000550	.....	.....	
56,000	56,000	.007325	.000650	.....	.....	
58,000	58,000	.008925	.001600	.....	.....	
60,000	60,000	.010350	.001425	.008125	.008125	
62,000	62,000	.011475	.001125	.....	.....	
64,000	64,000	.013100	.001625	.....	.....	
66,000	66,000	.014550	.001450	.....	.....	
68,000	68,000	.016225	.001675	.....	.....	
70,000	70,000	.018375	.002150	.....	.....	
107,800	107,800	.....	.....	.....	.....	Ultimate strength.

Failed by double flexure.

JACKET NO. 14.

No. 4364.

Marks, $\overset{8\ R_{14}\ J}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,000	44,000	.001500	.000167	0.	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.001733	.000066	.....	.....	
12,500	50,000	.001767	.000034	.....	.....	Elastic limit.
12,750	51,000	.008167	.006400	.....	.....	
13,000	52,000	.008833	.000666	.....	.....	
13,250	53,000	.009400	.000567	.....	.....	
13,500	54,000	.010500	.001100	.....	.....	
13,750	55,000	.011167	.000667	.....	.....	
22,970	91,880	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,889
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch...	.2033
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.5 from the neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.35*, ″.11

No. 911.

Marks, $\frac{8\ R_{14}\ J}{B\ T_5\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000075	.000075	.....	.....	
10,000	10,000	.000175	.000100	.....	.....	
15,000	15,000	.000300	.000125	.....	.....	
20,000	20,000	.000450	.000150	.....	.....	
25,000	25,000	.000625	.000175	.....	.....	
30,000	30,000	.000775	.000150	.....	.....	
35,000	35,000	.000925	.000150	.....	.....	
40,000	40,000	.001075	.000150	0.	.....	
41,000	41,000	.001075	0.	.....	.....	
42,000	42,000	.001125	.000050	.....	.....	
43,000	43,000	.001150	.000025	.....	.....	
44,000	44,000	.001175	.000025	.....	.....	
45,000	45,000	.001200	.000025	.....	.....	
46,000	46,000	.001250	.000050	.....	.....	
47,000	47,000	.001325	.000075	.....	.....	Elastic limit.
48,000	48,000	.001500	.000175	.....	.....	
49,000	49,000	.002800	.001300	.....	.....	
50,000	50,000	.004425	.001625	.002750	.002750	
52,000	52,000	.006775	.002350	.....	.....	
54,000	54,000	.008225	.001450	.....	.....	
56,000	56,000	.009575	.001350	.....	.....	
58,000	58,000	.010950	.001375	.....	.....	
60,000	60,000	.012375	.001425	.010200	.007450	
62,000	62,000	.013950	.001575	.....	.....	
64,000	64,000	.015500	.001550	.....	.....	
66,000	66,000	.017250	.001750	.....	.....	
68,000	68,000	.019000	.001750	.....	.....	
70,000	70,000	.020875	.001875	.018200	.008000	
81,200	81,200	.....	.....	.....	.....	Ultimate strength.

Failed by double flexure.

No. 4362.

Marks, $\frac{8\ R_{14}\ J}{M\ T_2\ M}$
Diameter, $''.565$.
Sectional area, .25 square inch.
Gauged length, $3''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,000	44,000	.001500	.000167	0.	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	Elastic limit.
12,750	51,000	.007333	.005600	.....	.....	
13,000	52,000	.008000	.000667	.....	.....	
13,250	53,000	.008500	.000500	.....	.....	
13,500	54,000	.009267	.000767	.....	.....	
13,750	55,000	.009933	.000666	.....	.....	
23,180	92,720	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	92,720
Elastic limit per square inch of original section	do	50,000
Elongation per inch after rupture	inch	.2000
Elongation per inch under strain at elastic limit	do	.001733
Reduction in diameter at point of rupture	do	.145
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		$1''.3$ from the neck
Character of broken surface		silky
Elongation of inch sections		$''.10$, $''.32$*, $''.18$

No. 4363.

Marks, $\frac{8\ R_{14}\ J}{M\ T_6\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,000	44,000	.001533	.000200	0.	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	Elastic limit.
12,000	48,000	.007600	.005967	.....	.....	
12,250	49,000	.008000	.000400	.....	.....	
12,500	50,000	.008933	.000933	.....	.....	
12,750	51,000	.009367	.000434	.....	.....	
13,000	52,000	.010133	.000766	.....	.....	
22,810	91,240	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	91,240
Elastic limit per square inch of original section	do	47,000
Elongation per inch after rupture	inch	.1967
Elongation per inch under strain at elastic limit	do	.001633
Reduction in diameter at point of rupture	do	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.5 from the neck
Character of broken surface		silky
Elongation of inch sections		″.17, ″.30*, ″.12

JACKET NO. 15.

No. 929.

Marks, $\frac{8\ R_{15}\ J}{B\ T_5\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000125	.000125	.....	.....	
10,000	10,000	.000275	.000150	.....	.....	
15,000	15,000	.000425	.000150	.....	.....	
20,000	20,000	.000625	.000200	.....	.....	
25,000	25,000	.000775	.000150	.....	.....	
30,000	30,000	.000950	.000175	0.	.....	
35,000	35,000	.001125	.000175	.....	.....	
40,000	40,000	.001275	.000150	.....	.....	
45,000	45,000	.001450	.000175	.....	.....	
50,000	50,000	.001575	.000125	.000625	.000025	
51,000	51,000	.001625	.000050	.....	.....	
52,000	52,000	.001700	.000075	.....	.....	Elastic limit.
53,000	53,000	.001875	.000175	.....	.....	
54,000	54,000	.003500	.001625	.....	.....	
55,000	55,000	.005350	.001850	.....	.....	
56,000	56,000	.005950	.000600	.....	.....	
58,000	58,000	.007325	.001375	.....	.....	
60,000	60,000	.008625	.001300	.....	.....	
62,000	62,000	.009975	.001350	.....	.....	
64,000	64,000	.011325	.001350	.....	.....	
66,000	66,000	.012625	.001300	.....	.....	
68,000	68,000	.014000	.001375	.....	.....	
70,000	70,000	.015600	.001600	.....	.....	
110,350	110,350	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

JACKET NO. 16.

No. 918.

Marks, $\frac{8\ R_{16}\ J}{B\ T_5\ M}$
Length, 5″.005.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000150	.000150	0.	.....	
10,000	10,000	.000325	.000175	.....	.....	
15,000	15,000	.000500	.000175	.....	.....	
20,000	20,000	.000650	.000150	.....	.....	
25,000	25,000	.000825	.000175	.....	.....	
30,000	30,000	.000975	.000150	0.	.....	
35,000	35,000	.001150	.000175	.....	.....	
40,000	40,000	.001250	.000100	0.	.....	
41,000	41,000	.001275	.000025	.....	.....	
42,000	42,000	.001300	.000025	.....	.....	
43,000	43,000	.001325	.000025	.....	.....	
44,000	44,000	.001350	.000025	.....	.....	
45,000	45,000	.001400	.000050	.....	.....	
46,000	46,000	.001450	.000050	.....	.....	
47,000	47,000	.001475	.000025	.....	.....	
48,000	48,000	.001500	.000025	.....	.....	
49,000	49,000	.001575	.000075	.....	.....	Elastic limit.
50,000	50,000	.002225	.000650	.000250	.000250	
51,000	51,000	.003000	.000775	.....	.....	
52,000	52,000	.004375	.001375	.....	.....	
54,000	54,000	.005875	.001500	.....	.....	
56,000	56,000	.007175	.001300	.....	.....	
58,000	58,000	.008650	.001475	.....	.....	
60,000	60,000	.010100	.001450	.007725	.007475	
62,000	62,000	.011275	.001175	.....	.....	
64,000	64,000	.012825	.001550	.....	.....	
66,000	66,000	.014300	.001475	.....	.....	
68,000	68,000	.015950	.001650	.....	.....	
70,000	70,000	.017450	.001500	.014625	.006300	
99,100	99,100	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

JACKET No. 17.

No. 4500.

Marks, $\begin{smallmatrix} 8\ R_{17}\ J \\ B\ T_2\ M \end{smallmatrix}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.000900	.000300	.....	.....	
10,000	40,000	.001233	.000333	0.	.....	
11,000	44,000	.001367	.000134	0.	.....	
11,250	45,000	.001400	.000033	.....	.....	
11,500	46,000	.001433	.000033	.....	.....	
11,750	47,000	.001467	.000034	.....	.....	
12,000	48,000	.001533	.000066	.....	.....	
12,250	49,000	.001567	.000034	.....	.....	
12,500	50,000	.001633	.000066	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	Elastic limit.
13,000	52,000	.001933	.000266	.....	.....	
13,250	53,000	.002400	.000467	.....	.....	
13,500	54,000	.003333	.000933	.....	.....	
13,750	55,000	.004500	.001167	.....	.....	
14,000	56,000	.005333	.000833	.....	.....	
24,410	97,640	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,640
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″ from the neck
Character of broken surface		silky
Elongation of inch sections		″.32*, ″.15, ″.10

No. 941.

Marks, $\begin{smallmatrix} 8\ R_{17}\ J \\ B\ T_5\ M \end{smallmatrix}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100	.....	.....	
10,000	10,000	.000225	.000125	.....	.....	
15,000	15,000	.000350	.000125	.....	.....	
20,000	20,000	.000500	.000150	.....	.....	
25,000	25,000	.000650	.000150	.....	.....	
30,000	30,000	.000825	.000175	0.	.....	
35,000	35,000	.001000	.000175	.....	.....	
40,000	40,000	.001150	.000150	0.	.....	
45,000	45,000	.001300	.000150	.....	.....	
46,000	46,000	.001350	.000050	.....	.....	
47,000	47,000	.001400	.000050	.....	.....	
48,000	48,000	.001450	.000050	.....	.....	
49,000	49,000	.001500	.000050	.....	.....	
50,000	50,000	.001550	.000050	.000025	.000025	
51,000	51,000	.001625	.000075	.....	.....	Elastic limit.
52,000	52,000	.001725	.000100	.....	.....	
53,000	53,000	.001850	.000125	.....	.....	
54,000	54,000	.002575	.000725	.....	.....	
55,000	55,000	.003750	.001175	.001875	.001859	
56,000	56,000	.004300	.000550	.....	.....	
57,000	57,000	.005050	.000750	.....	.....	
58,000	58,000	.005700	.000650	.....	.....	
59,000	59,000	.006450	.000750	.....	.....	
60,000	60,000	.007175	.000725	.005050	.003175	
62,000	62,000	.008500	.001325	.....	.....	
64,000	64,000	.010050	.001550	.....	.....	
66,000	66,000	.011400	.001350	.....	.....	
68,000	68,000	.012700	.001300	.....	.....	
70,000	70,000	.014300	.001600	.011675	.006625	
72,000	72,000	.015650	.001350	.....	.....	
74,000	74,000	.017000	.001350	.....	.....	
76,000	76,000	.018625	.001625	.....	.....	
78,000	78,000	.020225	.001600	.....	.....	
80,000	80,000	.022150	.001925	.019125	.007450	
110,300	110,300	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4499.

Marks, $\frac{8\ R_{17}\ J}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
11,000	44,000	.001433	.000133	0.	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	Elastic limit.
13,250	53,000	.002267	.000500	.....	.....	
13,500	54,000	.003933	.001666	.....	.....	
13,750	55,000	.004667	.000734	.....	.....	
14,000	56,000	.005567	.000900	.....	.....	
14,250	57,000	.006233	.000666	.....	.....	
24,920	99,680	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	99,680
Elastic limit per square inch of original section	do	52,000
Elongation per inch after rupture	inch	.1967
Elongation per inch under strain at elastic limit	do	.001767
Reduction in diameter at point of rupture	do	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.45 from the neck
Character of broken surface		silky
Elongation of inch sections		″.16, ″.32*, ″.11

JACKET NO. 18.

No. 934.

Marks, $\frac{8\ R_{18}\ J}{B\ T_5\ M}$
Length, 5″.
Diameter ″1.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000125	.000125	.....	.....	
10,000	10,000	.000300	.000175	.....	.....	
15,000	15,000	.000450	.000150	.....	.....	
20,000	20,000	.000600	.000150	.....	.....	
25,000	25,000	.000775	.000175	.....	.....	
30,000	30,000	.000925	.000150	0.	.....	
35,000	35,000	.001075	.000150	.....	.....	
40,000	40,000	.001250	.000175	.000050	.000050	
45,000	45,000	.001375	.000125	.....	.....	
48,000	48,000	.001475	.000100	.....	.....	
49,000	49,000	.001525	.000050	.....	.....	Elastic limit.
50,000	50,000	.001725	.000200	.000275	.000225	
51,000	51,000	.005650	.003925	.....	.....	
52,000	52,000	.006100	.000450	.....	.....	
53,000	53,000	.006725	.000625	.....	.....	
54,000	54,000	.007425	.000700	.....	.....	
55,000	55,000	.008125	.000700	.006100	.005825	
56,000	56,000	.008700	.000575	.....	.....	
57,000	57,000	.009075	.000375	.....	.....	
58,000	58,000	.010025	.000950	.....	.....	
59,000	59,000	.010725	.000700	.....	.....	
60,000	60,000	.011575	.000850	.009325	.009225	
61,000	61,000	.012100	.000525	.....	.....	
62,000	62,000	.012775	.000675	.....	.....	
63,000	63,000	.013500	.000725	.....	.....	
64,000	64,000	.014425	.000925	.....	.....	
65,000	65,000	.015200	.000775	.012725	.003400	
66,000	66,000	.015975	.000775	.....	.....	
67,000	67,000	.016500	.000525	.....	.....	
68,000	68,000	.017525	.001025	.....	.....	
69,000	69,000	.018300	.000775	.....	.....	
70,000	70,000	.019150	.000850	.016500	.003775	
106,700	106,700	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

JACKET NO. 19.

No. 927.

Marks, $\frac{8\,R_{19}\,J}{B\,T_5\,M}$
Length, 5″.
Diameter, 1″.125.
Sectional area, .994 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
994	1,000	0.	0.	0.	0.	Initial load.
4,970	5,000	.000125	.000125	.....	.....	
9,940	10,000	.000275	.000150	.....	.....	
14,910	15,000	.000450	.000175	.....	.....	
19,980	20,000	.000600	.000150	.....	.....	
24,850	25,000	.000775	.000175	.....	.....	
29,820	30,000	.000950	.000175	0.	.....	
34,790	35,000	.001100	.000150	.....	.....	
39,760	40,000	.001275	.000175	0.	.....	
44,730	45,000	.001450	.000175	.....	.....	
49,700	50,000	.001575	.000125	.....	.....	
50,694	51,000	.001600	.000025	.....	.....	
51,688	52,000	.001625	.000025	.....	.....	Elastic limit.
52,682	53,000	.002175	.000550	.....	.....	
53,676	54,000	.005375	.003200	.....	.....	
54,670	55,000	.006100	.000725	.....	.....	
55,664	56,000	.006725	.000625	.....	.....	
57,652	58,000	.008150	.001425	.....	.....	
59,640	60,000	.009675	.001525	.....	.....	
61,628	62,000	.011000	.001325	.....	.....	
63,616	64,000	.012500	.001500	.....	.....	
65,604	66,000	.013875	.001375	.....	.....	
67,592	68,000	.015425	.001550	.....	.....	
69,580	70,000	.017100	.001675	.....	.....	
102,200	102,820	.....	.....	.....	.....	Ultimate strength.

Failed by double flexure.

JACKET NO. 20.

No. 4548.

Marks, $\frac{8\ R_{20}\ J}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
10,000	40,000	.001333	.000400	0.	.....	
11,000	44,000	.001467	.000134	0.	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	Elastic limit.
12,500	50,000	.001933	.000300	.....	.....	
12,750	51,000	.003167	.001234	.....	.....	
13,000	52,000	.004733	.001566	.....	.....	
13,250	53,000	.005267	.000534	.....	.....	
13,500	54,000	.006333	.001066	.....	.....	
24,110	96,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,440
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.1957
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		at the middle of stem
Character of broken surface		silky, serrated
Elongation of inch sections		″.12, ″.35*, ″.12

No. 955.

Marks, $\frac{8\ R_{20}\ J}{B\ T_5\ M}$
Length, 5″.
Diameter, 1″.126.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000075	.000075	.....	.....	
10,000	10,000	.000200	.000125	.....	.....	
15,000	15,000	.000325	.000125	.....	.....	
20,000	20,000	.000450	.000125	.....	.....	
25,000	25,000	.000575	.000125	.....	.....	
30,000	30,000	.000700	.000125	0.	.....	
35,000	35,000	.000825	.000125	.....	.....	
40,000	40,000	.000975	.000150	0.	.....	
45,000	45,000	.001125	.000150	.....	.....	
46,000	46,000	.001175	.000050	.....	.....	
47,000	47,000	.001200	.000025	.....	.....	
48,000	48,000	.001250	.000050	.....	.....	
49,000	49,000	.001275	.000025	.....	.....	Elastic limit.
50,000	50,000	.001975	.000700	.000500	.000500	
51,000	51,000	.002425	.000450	.....	.....	
52,000	52,000	.003250	.000825	.....	.....	
53,000	53,000	.003875	.000625	.....	.....	
54,000	54,000	.004500	.000625	.....	.....	
56,000	56,000	.005675	.001175	.....	.....	
58,000	58,000	.007575	.001900	.....	.....	
60,000	60,000	.008925	.001350	.....	.....	
62,000	62,000	.010500	.001575	.....	.....	
64,000	64,000	.011800	.001300	.....	.....	
66,000	66,000	.013250	.001450	.....	.....	
68,000	68,000	.014825	.001575	.....	.....	
70,000	70,000	.016550	.001725	.....	.....	
72,000	72,000	.018000	.001450	.....	.....	
74,000	74,000	.019750	.001750	.....	.....	
76,000	76,000	.021175	.001425	.....	.....	
78,000	78,000	.022875	.001700	.....	.....	
80,000	80,000	.025050	.002175	.....	.....	
107,780	107,780	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4547.

Marks $\overset{8\ R_{20}\ J}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000367	.000234	.....	.....	
5,000	20,000	.000667	.000300	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,000	44,000	.001433	.000100	0.	.....	
11,250	45,000	.001500	.000067	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001700	.000067	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	
12,750	51,000	.001800	.000067	.....	.....	Elastic limit.
13,000	52,000	.001933	.000133	.....	.....	
13,250	53,000	.002267	.000334	.....	.....	
13,500	54,000	.002767	.000500	.....	.....	
13,750	55,000	.003333	.000566	.....	.....	
14,000	56,000	.004267	.000934	.....	.....	
25,010	100,040	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	100,040
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″.65 from the neck
Character of broken surface		granular, 40 per cent; silky serrated, 60 per cent
Elongation of inch sections		″.12, ″.30*, ″.12

JACKET NO. 23.

No. 4554.

Marks, $\frac{8\ R_{23}\ J}{B\ T_2\ M}$
Diameter, $''.564$.
Sectional area, .25 square inch.
Gauged length, $3''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	.000033	.000033	
11,000	44,000	.001533	.000200	.000033	0.	
11,250	45,000	.001600	.000067	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	Elastic limit.
12,250	49,000	.001867	.000167	.....	.....	
12,500	50,000	.003167	.001300	.....	.....	
12,750	51,000	.004000	.000833	.....	.....	
13,000	52,000	.004933	.000933	.....	.....	
13,250	53,000	.005667	.000734	.....	.....	
24,020	96,080	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,080
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.1567
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		$1''.1$ from neck
Character of broken surface		granular; dull serrated spot at the circumference
Elongation of inch sections		$''.13$, $''.17$, $''.17$*

No. 4553.

Marks, $\frac{8\,R_{23}\,J}{M\,T_3\,M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	.000033	.000033	
11,000	44,000	.001467	.000134	.000033	0.	
11,250	45,000	.001533	.000066	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001633	.000066	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	Elastic limit.
12,750	51,000	.001900	.000167	.....	.....	
13,000	52,000	.002133	.000233	.....	.....	
13,250	53,000	.002767	.000634	.....	.....	
13,500	54,000	.003900	.001133	.....	.....	
13,750	55,000	.004600	.000700	.....	.....	
24,720	98,880	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	98,880
Elastic limit per square inch of original section	do	50,000
Elongation per inch after rupture	inch	.1867
Elongation per inch under strain at elastic limit	do	.001733
Reduction in diameter at point of rupture	do	.124
Reduction in area after rupture, per centum of original section		39.2
Position of rupture		1″.2 from neck
Character of broken surface		granular; silky center
Elongation of inch sections		″.24*, ″.22*, ″.10.

Specific Gravity and Hardness of Tubes, Jackets, and Hoops.

8-INCH STEEL B. L. RIFLES.

[No tension tests of these specimens.]

Number of rifle.	Marks.	Specific gravity.	Hardness.
2	8 R_2 T B R_{11} M	7.8584	17.53
5	8 R_5 T B R_{14} M	7.8609	19.29
6	8 R_6 T B R_{11} M	7.8571	18.68
7	8 R_7 T B R_{11} M	7.8519	17.53
8	8 R_8 T B R_5 M	7.8576	19.92
9	8 R_9 T B R_8 M	7.8561	18.38
11	8 R_{11} T B R_8 M	7.8552	19.90
12	8 R_{12} T B R_5 M	7.8520	17.17
13	8 R_{13} T B R_8 M	7.8516	17.99
14	8 R_{14} T B R_{11} M	7.8546	15.51
15	8 R_{15} T B R_5 M	7.8592	17.62
16	8 R_{16} T B R_5 M	7.8588	18.98
17	8 R_{17} T B R_5 M	7.8534	18.29
18	8 R_{18} T B R_5 M	7.8629	18.19
19	8 R_{19} T B R_5 M	7.8564	15.58
20	8 R_{20} T B R_5 M	7.8572	17.62
21	8 R_{21} T B R_5 M	7.8583	17.53
2	8 R_2 J B R_{18} M	7.8527	19.29
5	8 R_5 J B R_6 M	7.8549	19.08
7	8 R_7 J B R_{10} M	7.8586	18.88
8	8 R_8 J B R_{10} M	7.8548	16.90
9	8 R_9 J B R_{10} M	7.8584	16.82
10	8 R_{10} J B R_{14} M	7.8560	20.03
11	8 R_{11} J B R_6 M	7.8528	16.15
12	8 R_{12} J B R_{10} M	7.8545	20.03
13	8 R_{13} J B R_6 M	7.8533	18.09
14	8 R_{14} J B R_6 M	7.8517	17.53
15	8 R_{15} J B R_6 M	7.8584	18.78
16	8 R_{16} J B R_6 M	7.8525	19.60
17	8 R_{17} J B R_6 M	7.8566	20.25
18	8 R_{18} J B R_6 M	7.8526	17.99
19	8 R_{19} J B R_6 M	7.8542	19.81
20	8 R_{20} J B R_6 M	7.8566	19.49
6	8 R_6 A_5 R_4 M	7.8522	21.64
7	8 R_7 A_3 R_4 M	7.8496	20.35
8	8 R_8 A_5 R_4 M	7.8512	20.70
9	8 R_9 A_4 R R_4 M	7.8580	19.70
10	8 R_{10} A_5 B R_4 M	7.8482	21.64
11	8 R_{11} A_3 R_1 M	7.8461	20.36
12	8 R_{12} A_5 R_4 M	7.8467	23.30
14	8 R_{14} A_5 R_4 M	7.8520	20.93
16	8 R_{16} A_4 B R_4 M	7.8548	23.17
17	8 R_{17} A_5 R_4 M	7.8512	22.51
18	8 R_{18} A_5 R_1 M	7.8504	22.14
19	8 R_{19} A_3 R_4 M	7.8509	23.17
20	8 R_{20} A_5 R_7 M	7.8536	23.84
23	8 R_{23} A_3 R_2 M	7.8521	22.39

TABULATION OF TENSION SPECIMENS FROM 8-INCH STEEL B. L. RIFLES.

[Stems, 3 inches long; .564 inch diameter.]

No of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.
			Pounds.	*Pounds.*	*Per ct.*	*Per ct.*	
4319	Tube No. 2....	Middle .	44,000	94,120	17.7	36.4	Silky, 80 per cent; fine granular, 20 per cent.
4320	....do	...do	44,000	83,920	21.0	49.7	Silky.
4313	Tube No. 7....	...do	50,000	91,680	20.3	27.6	Silky, 40 per cent; granular, 60 per cent.
4314	....do	...do	52,000	87,560	22,3	39.2	Silky.
4282	Tube No. 8....	...do	52,000	99,240	16.7	36.4	Silky, slightly granular.
4281	....do	...do	55,000	90,880	19.3	41.9	Silky.
4355	Tube No. 11...	...do	46,000	89,080	16.0	24.6	Granular and dull serrated.
4377	....do	...do	46,000	87,720	16.7	27.6	Silky, serrated and granular.
4353	....do	...do	50,000	85,960	25.3	47.2	Silky.
4354	....do	Inside ..	49,000	98,440	20.0	44.6	Do.
4375	....do	Outside.	48,000	90,560	16.0	24.6	Silky, oblique, 50 per cent; granular, 50 per cent.
4376	....do	Middle .	47,000	86,360	20.7	33.5	Silky, oblique.
4361	Tube No. 13...	...do	49,000	94,240	17.3	33.5	Granular and silky, oblique.
4373	....do	...do	45,000	90,360	19.7	41.9	Silky.
4359	....do	...do	55,000	90,760	20.3	41.9	Do.
4360	....do	...do	51,000	86,760	22.3	41.9	Do.
4371	....do	Inside ..	50,000	84,840	26.3	52.2	Do.
4372	....do	Middle .	50,000	82,880	26.3	52.2	Do.
4408	Tube No. 17...	...do	49,000	91,440	20.7	39.2	Granular, 50 per cent; silky, 50 per cent.
4407	....do	...do	49,000	93,680	20.3	47.2	Silky.
4498	Tube No. 20...	...do	48,000	91,160	20.3	36.4	Granular, 60 per cent; silky, serrated, 40 per cent.
4497	....do	...do	49,000	92,240	20.7	44.6	Silky.
4510	Tube No. 23...	...do	48,000	88,120	22.0	44.6	Do.
4509	....do	...do	51,000	95,360	18.0	36.4	Granular, 55 per cent; silky, 45 per cent.
4347	Jacket No. 2 ..	...do	44,000	86,320	21.7	47.2	Silky.
4346	....do	...do	49,000	86,120	21.0	41.9	Do.
4316	Jacket No. 8 ..	...do	49,000	87,160	20.0	41.9	Do.
4315	....do	...do	48,000	88,240	21.3	41.9	Do.
4342	Jacket No, 11 .	...do	54,000	91,160	20.3	47.2	Do.
4340	....do	...do	52,000	97,680	19.7	41.9	Do.
4341	....do	Inside ..	51,000	97,880	19.7	41.9	Do.
4361	Jacket No. 14 .	Middle .	50,000	91,880	20.3	44.6	Do.
4362	....do	...do	50,000	92,720	20.0	44.6	Do.
4363	....do	...do	47,000	91,240	19.7	39.2	Do.
4500	Jacket No. 17 .	...do	51,000	97,640	19.0	44.6	Do.
4499	....do	...do	52,000	99,680	19.7	41.9	Do.
4548	Jacket No. 20 .	...do	48,000	96,440	19.7	44.6	Silky, serrated.
4547	....do	...do	51,000	100,040	18.3	36.4	Granular, 40 per cent; silky, serrated, 60 per cent.
4554	Jacket No. 23 .	...do	48,000	96,080	15.7	18.3	Granular, dull serrated spot.
4553	....do	...do	50,000	98,880	18.7	39.2	Granular, silky center.

TABULATION OF COMPRESSION SPECIMENS FROM 8-INCH STEEL B. L. RIFLES.

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Ultimate strength per square inch.	Manner of failure.	Length.	Diameter.
			Pounds.	*Pounds.*		*Inches.*	*Inches.*
901	Tube No. 2	Middle	46,000	108,700	Triple flexure	5	1.128
893	Tube No. 5	do	45,000	85,580	do	5	.798
905	Tube No. 6	do	47,000	107,800	do	5	1.128
897	Tube No. 7	do	48,000	96,650	do	5	1.0092
898	Tube No. 8	do	52,000	90,540	do	5	.798
906	Tube No. 9	do	47,000	105,600	do	5	1.128
914	Tube No. 11	do	44,000	95,180	do	4.975	1.129
925	do	do	41,000	92,100	do	5	1.128
915	Tube No. 12	do	46,330	94,660	Double flexure	5.009	1.103
916	Tube No. 13	do	44,000	92,200	Triple flexure	5	1.105
939	Tube No. 15	do	41,000	97,100	do	5	1.128
908	Tube No. 16	do	47,000	105,600	do	5	1.128
933	Tube No. 17	do	49,000	99,800	do	5	1.128
926	Tube No. 18	do	46,000	101,300	do	5	1.128
940	Tube No. 19	do	49,000	96,200	do	5	1.128
942	Tube No. 20	do	49,000	102,200	do	5	1.128
947	Tube No. 21	do	47,000	96,810	do	5	1.128
928	Jacket No. 2	do	51,000	108,330	do	5	1.126
894	Jacket No. 5	do	46,000	97,300	do	5	1.0092
895	Jacket No. 7	do	48,000	96,775	do	5	1.0092
896	Jacket No. 8	do	47,000	93,600	do	5	1.0092
909	Jacket No. 9	do	44,000	88,200	Double flexure	5	1.128
917	Jacket No. 10	do	48,000	103,100	Triple flexure	5	1.128
902	Jacket No. 11	do	50,000	103,600	do	5	1.128
910	Jacket No. 12	do	52,000	94,200	Double flexure	5	1.128
907	Jacket No. 13	do	50,000	107,800	do	5	1.128
911	Jacket No. 14	do	47,000	81,200	do	5	1.128
929	Jacket No. 15	do	52,000	110,350	Triple flexure	5	1.128
918	Jacket No. 16	do	49,000	99,100	do	5.005	1.129
941	Jacket No. 17	do	51,000	110,300	do	5	1.128
934	Jacket No. 18	do	49,000	106,700	do	5	1.128
927	Jacket No. 19	do	52,000	102,820	Double flexure	5	1.125
950	Jacket No. 20	do	49,000	107,780	Triple flexure	5	1.126

10-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES JACKETS, AND HOOPS.

Tube No. 2.

No. 943.

Marks, $\frac{10\,R_2\,T}{B\,T_{10}\,M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000100	.000100	.....	.....	
10,000	10,000	.000250	.000150	.....	.....	
15,000	15,000	.000375	.000125	.....	.....	
20,000	20,000	.000500	.000125	.....	.....	
25,000	25,000	.000650	.000150	.....	.....	
30,000	30,000	.000800	.000150	0.	.....	
35,000	35,000	.000950	.000150	.....	.....	
40,000	40,000	.001125	.000175	0.	.....	
41,000	41,000	.001150	.000025	.....	.....	
42,000	42,000	.001175	.000025	.....	.....	
43,000	43,000	.001200	.000025	.....	.....	
44,000	44,000	.001225	.000025	.....	.....	
45,000	45,000	.001250	.000025	0.	.....	
46,000	46,000	.001275	.000025	.....	.....	
47,000	47,000	.001325	.000050	.....	.....	
48,000	48,000	.001375	.000050	.....	.....	Elastic limit.
49,000	49,000	.001650	.000275	.....	.....	
50,000	50,000	.002100	.000450	.000525	.000525	
52,000	52,000	.003275	.001175	.....	.....	
54,000	54,000	.004825	.001550	.....	.....	
56,000	56,000	.006100	.001275	.....	.....	
58,000	58,000	.007650	.001550	.....	.....	
60,000	60,000	.009000	.001350	.006825	.006300	
62,000	62,000	.010275	.001275	.....	.....	
64,000	64,000	.011625	.001350	.....	.....	
66,000	66,000	.013125	.001500	.....	.....	
68,000	68,000	.014825	.001700	.....	.....	
70,000	70,000	.016325	.001500	.013700	.006875	
72,000	72,000	.017875	.001550	.....	.....	
74,000	74,000	.019675	.001800	.....	.....	
76,000	76,000	.021325	.001650	.....	.....	
78,000	78,000	.023450	.002125	.020500	.006800	
105,900	105,900	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

Tube No. 3.

No. 948.

Marks, $\frac{10\ R_3\ T}{B\ T_4\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000150	.000150	0.	.....	
10,000	10,000	.000300	.000150	.....	.....	
15,000	15,000	.000450	.000150	.....	.....	
20,000	20,000	.000600	.000150	.....	.....	
25,000	25,000	.000750	.000150	.....	.....	
30,000	30,000	.000900	.000150	0.	.....	
35,000	35,000	.001075	.000175	.....	.....	
40.000	40,000	.001250	.000175	.000025	.000025	
41,000	41,000	.001300	.000050	.....	.....	
42,000	42,000	.001350	.000050	.....	.....	
43,000	43,000	.001375	.000025	.....	.....	
44,000	44,000	.001425	.000050	.....	.....	
45,000	45,000	.001475	.000050	.....	.....	
46,000	46,000	.001525	.000050	.....	.....	Elastic limit.
47,000	47,000	.001625	.000100	.....	.....	
48,000	48,000	.001825	.000200	.....	.....	
49,000	49,000	.002325	.000500	.....	.....	
50,000	50,000	.003075	.000750	.001425	.001400	
51,000	51,000	.003550	.000475	.....	.....	
52,000	52,000	.004250	.000700	.....	.....	
53,000	53,000	.005050	.000800	.....	.....	
54,000	54,000	.005750	.000700	.....	.....	
56,000	56,000	.007225	.001475	.....	.....	
58,000	58,000	.008625	.001400	.....	.....	
60,000	60,000	.010050	.001425	.007800	.006375	
62,000	62,000	.011325	.001275	.....	.....	
64,000	64,000	.012950	.001625	.....	.....	
66,000	66,000	.014450	.001500	.....	.....	
68,000	68,000	.016050	.001600	.....	.....	
70,000	70,000	.017775	.001725	.015125	.007325	
106,500	106,500	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

JACKET NO. 2.

No. 935.

Marks, $\frac{10\ R_2\ J}{B\ T_9\ M}$
Length, 5″.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
5,000	5,000	.000125	.000125	.....	.....	
10,000	10,000	.000250	.000125	.....	.....	
15,000	15,000	.000400	.000150	.....	.....	
20,000	20,000	.000575	.000175	.....	.....	
25,000	25,000	.000750	.000175	.....	.....	
30,000	30,000	.000900	.000150	0.	.....	
35,000	35,000	.001050	.000150	.....	.....	
40,000	40,000	.001200	.000150	0.	.....	
45,000	45,000	.001375	.000175	0.	.....	
46,000	46,000	.001425	.000050	.....	.....	
47,000	47,000	.001450	.000025	.....	.....	
48,000	48,000	.001500	.000050	.....	.....	Elastic limit.
49,000	49,000	.001750	.000250	.....	.....	
50,000	50,000	.002425	.000675	.000700	.000700	
51,000	51,000	.003150	.000725	.....	.....	
52,000	52,000	.004000	.000850	.....	.....	
53,000	53,000	.004625	.000625	.....	.....	
54,000	54,000	.005175	.000550	.....	.....	
55,000	55,000	.006050	.000875	.003950	.003250	
56,000	56,000	.006675	.000625	.....	.....	
57,000	57,000	.007375	.000700	.....	.....	
58,000	58,000	.007825	.000450	.....	.....	
59,000	59,000	.008525	.000700	.....	.....	
60,000	60,000	.009275	.000750	.006900	.002950	
61,000	61,000	.009825	.000550	.....	.....	
62,000	62,000	.010450	.000625	.....	.....	
63,000	63,000	.011250	.000800	.....	.....	
64,000	64,000	.011875	.000625	.....	.....	
65,000	65,000	.012700	.000825	.010100	.003200	
66,000	66,000	.013425	.000725	.....	.....	
67,000	67,000	.014025	.000600	.....	.....	
68,000	68,000	.014750	.000725	.....	.....	
69,000	69,000	.015625	.000875	.....	.....	
70,000	70,000	.016125	.000500	.013550	.003450	
106,700	106,700	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

10-INCH STEEL B. L. RIFLES.

SPECIFIC GRAVITY AND HARDNESS OF TUBES, JACKETS, AND HOOPS.

[No tension tests of these specimens.]

No. of rifle.	Marks.	Specific gravity.	Hardness.
2	10 R_2 T B R_1 M	7.8562	19.39
3	10 R_3 T B R_5 M	7.8535	18.19
2	10 R_2 J B R_{10} M	7.8570	19.08
2	10 R_2 A_2 R_4 M	7.8554	21.77
3	10 R_3 B_4 M R_4 M	7.8501	22.77
4	10 R_4 A_3 M R_4 M	7.8487	22.90

10-INCH WIRE-WOUND RIFLE, NO. 1.

SPECIMENS FROM STEEL CASTINGS FOR JACKET AND HOOPS.

JACKET NO. —.

No. 4321.

Marks, $\frac{10\ W\ R\ J}{B\ T_1\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	0.	.....	
3,750	15,000	.000433	.000100	0.	.....	
5,000	20,000	.000600	.000167	0.	.....	
6,250	25,000	.000767	.000167	0.	.....	
7,500	30,000	.001000	.000233	0.	.....	
8,750	35,000	.001233	.000233	.000033	.000033	
9,000	36,000	.001267	.000034	.....	.....	
9,250	37,000	.001333	.000066	.....	.....	
9,500	38,000	.001367	.000034	.....	.....	
9,750	39,000	.001400	.000033	.....	.....	Elastic limit.
10,000	40,000	.001533	.000100	.000200	.000167	
10,250	41,000	.001633	.000100	.....	.....	
10,500	42,000	.001733	.000100	.....	.....	
10,750	43,000	.001800	.000067	.....	.....	
11,000	44,000	.001867	.000067	.....	.....	
11,250	45,000	.001933	.000066	.000333	.000133	
11,500	46,000	.002033	.000100	.....	.....	
11,750	47,000	.002133	.000100	.....	.....	
12,000	48,000	.002200	.000067	.....	.....	
12,250	49,000	.002333	.000133	.....	.....	
12,500	50,000	.002433	.000100	.000733	.000400	
12,750	51,000	.002667	.000234	.....	.....	
13,000	52,000	.002900	.000233	.....	.....	
13,250	53,000	.003067	.000167	.....	.....	
13,500	54,000	.003833	.000766	.....	.....	
14,000	56,000	.0067	.002867	.....	.....	
14,500	58,000	.0100	.0033	.....	.....	
15,000	60,000	.0133	.0033	.....	.....	
15,500	62,000	.0150	.0017	.....	.....	
16,000	64,000	.0167	.0017	.....	.....	
16,500	66,000	.0200	.0033	.....	.....	
17,000	68,000	.0217	.0017	.....	.....	
17,500	70,000	.0250	.0033	.....	.....	
18,000	72,000	.0283	.0033	.....	.....	
18,500	74,000	.0317	.0034	.....	.....	
19,000	76,000	.0383	.0066	.....	.....	
19,500	78,000	.0417	.0034	.....	.....	
20,000	80,000	.0467	.0050	.....	.....	
20,500	82,000	.0517	.0050	.....	.....	
21,000	84,000	.0617	.0100	.....	.....	
21,500	86,000	.0717	.0100	.....	.....	
22,000	88,000	.0883	.0166	.....	.....	
22,370	89,480	.1267	.0384	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	89,480
Elastic limit per square inch of original section	do	39,000
Elongation per inch after rupture	inch	.1467
Elongation per inch under strain at elastic limit	do	.001400
Reduction in diameter at point of rupture	do	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		″.40 from the neck
Character of broken surface		dull silky, 85 per cent; granular, 15 per cent
Elongation of inch sections		″.22* ″.10, ″.12

No. 4322.

Marks, $\frac{10\ W\ R_1\ J}{B\ T_2\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2.500	10,000	.000333	.000233	.....	.....	
3,750	15,000	.000500	.000167	.....	.....	
5,000	20,000	.000667	.000167	0.	.....	
6,250	25,000	.000833	.000166	.....	.....	
7,500	30,000	.001033	.000200	.000067	.000067	
7,750	31,000	.001100	.000067	.....	.....	
8,000	32,000	.001133	.000033	.....	.....	
8,250	33,000	.001200	.000067	.....	.....	Elastic limit (approximate).
8,500	34,000	.001300	.000100	.....	.....	
8,750	35,000	.001333	.000033	.000233	.000166	
9,000	36,000	.001400	.000067	.....	.....	
9,250	37,000	.801467	.000067	.....	.....	
9,500	38,000	.001533	.000066	.....	.....	
9,750	39,000	.001633	.000100	.....	.....	
10,000	40,000	.001700	.000067	.000367	.000134	
10,250	41,000	.001800	.000100	.....	.....	
10,500	42,000	.001900	.000100	.....	.....	
10,750	43,000	.002000	.000100	.....	.....	
11,000	44,000	.002067	.000067	.....	.....	
11,250	45,000	.002200	.000133	.000700	.000333	
11,500	46,000	.002367	.000167	.....	.....	
11,750	47,000	.002500	.000133	.....	.....	
12,000	48,000	.002633	.000133	.....	.....	
12,250	49,000	.002767	.000134	.....	.....	
12,500	50,000	.003067	.000300	.001367	.000667	
13,000	52,000	.003600	.000533	.....	.....	
13,500	54,000	.004400	.000800	.....	.....	
14,000	56,000	.005667	.901267	.....	.....	
14,500	58,000	.007167	.001500	.....	.....	
15,000	60,000	.009000	.001833	.....	.....	
15,500	62,000	.010833	.001833	.....	.....	
16,000	64,000	.013000	.002167	.....	.....	
16,500	66,000	.015167	.002167	.....	.....	
17,000	68,000	.017500	.002333	.....	.....	
17,500	70,000	.020000	.002500	.....	.....	
18,000	72,000	.022900	.062900	.....	.....	
18,500	74,000	.026000	.003100	.....	.....	
19,000	76,000	,029167	.003167	.....	.....	
19,500	78,000	.033000	.003833	.....	.....	
20,000	80,000	.037333	.004333	.....	.....	
20,500	82,000	.045000	.007667	.....	.....	
21,000	84,000	.0500	.0050	.....	.....	
21,500	86,000	.0583	.0083	.....	.....	
22,000	88,000	.0650	.0067	.....	.....	
22,500	90,000	.0800	.0150	.....	.....	
23,000	92,000	.1067	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength, per square inch of original section	pounds..	92,000
Elastic limit, per square inch of original section	do....	33,000
Elongation per inch after rupture	inch..	.1333
Elongation per inch under strain at elastic limit	do....	.001200
Reduction in diameter at point of rupture	do....	.064
Reduction in area after rupture, per centum of original section		21.4
Position of rupture		″.20 from the neck
Character of broken surface		granular, dull silky spot at the circumference
Elongation of inch sections		″.10, ″.09, ″.21*

No. 4323.

Marks, $\frac{10\ W\ R_1\ J}{B\ T_3\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
3,750	15,000	.000433	.000166	.....	.....	
5,000	20,000	.000600	.000167	0.	.....	
6,250	25,000	.000733	.000133	.....	.....	
7,500	30,000	.001000	.000267	.000033	.000033	
8,000	32,000	.001067	.000067	.....	.....	
8,250	33,000	.001100	.000033	.....	.....	
8,500	34,000	.001200	.000100	.....	.....	
8,750	35,000	.001233	.000033	.00067	.000034	
9,000	36,000	.001300	.000067	.....	.....	
9,250	37,000	.001367	.000067	.....	.....	
9,500	38,000	.001400	.000033	.....	.....	
9,750	39,000	.001433	.000033	.....	.....	Elastic limit.
10,000	40,000	.001533	.000100	.000267	.000200	
10,250	41,000	.001633	.000100	.....	.....	
10,500	42,000	.001700	.000067	.....	.....	
10,750	43,000	.001767	.000067	.....	.....	
11,000	44,000	.001833	.000066	.....	.....	
11,250	45,000	.001933	.000100	.000400	.000133	
11,500	46,000	.002067	.000134	.....	.....	
11,750	47,000	.002133	.000066	.....	.....	
12,000	48,000	.002233	.000100	.....	.....	
12,250	49,000	.002367	.000134	.....	.....	
12,500	50,000	.002533	.000166	.000767	.000367	
13,000	52,000	.002900	.000367	.....	.....	
13,500	54,000	.003333	.000433	.....	.....	
14,000	56,000	.003933	.000600	.....	.....	
14,500	58,000	.004833	.000900	.....	.....	
15,000	60,000	.006100	.001267	.....	.....	
15,500	62,000	.007933	.001833	.....	.....	
16,000	64,000	.009400	.001467	.....	.....	
16,500	66,000	.011633	.002233	.....	.....	
17,000	68,000	.013733	.002100	.....	.....	
17,500	70,000	.015733	.002000	.....	.....	
18,000	72,000	.018333	.002600	.....	.....	
18,500	74,000	.020500	.002167	.....	.....	
19,000	76,000	.023667	.003167	.....	.....	
19,500	78,000	.026667	.003000	.....	.....	
20,000	80,000	.030333	.003666	.....	.....	
20,500	82,000	.0350	.004667	.....	.....	
21,000	84,000	.0383	.0033	.....	.....	
21,500	86,000	.0467	.0084	.....	.....	
22,000	88,000	.0517	.0050	.....	.....	
22,500	90,000	.0600	.0083	.....	.....	
23,000	92,000	.0733	.0133	.....	.....	
23,500	94,000	.1000	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	94,000
Elastic limit per square inch of original section	do	39,000
Elongation per inch after rupture	inch	.1233
Elongation per inch under strain at elastic limit	do	.001433
Reduction in diameter at point of rupture	do	.104
Reduction in area after rupture, per centum of original section		33.5
Position of rupture		″.35 from the neck
Character of broken surface		granular, 60 per cent; silky, 40 per cent
Elongation of inch sections		″.07, ″.07, ″.23*

No. 4324.

Marks, $\frac{10\ W\ R_1\ J}{B\ T_4\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
3,750	15,000	.000400	.000133	.....	.....	
5,000	20,000	.000600	.000200	0.	.....	
6,250	25,000	.000767	.000167	.....	.....	
7,500	30,000	.001000	.000233	.000033	.000033	
8,750	35,000	.001200	.000200	.....	.....	
9,000	36,000	.001233	.000033	.....	.....	
9,250	37,000	.001300	.000067	.....	.....	
9,500	38,000	.001333	.000033	.....	.....	
9,750	39,000	.001367	.000034	.....	.....	
10,000	40,000	.001400	.000033	.000133	.000100	Elastic limit.
10,250	41,000	.001467	.000067	.....	.....	
10,500	42,000	.001567	.000100	.....	.....	
10,750	43,000	.001633	.000066	.....	.....	
11,000	44,000	.001700	.000067	.....	.....	
11,250	45,000	.001733	.000033	.000267	.000134	
11,500	46,000	.001800	.000067	.....	.....	
11,750	47,000	.001867	.000067	.....	.....	
12,000	48,000	.001933	.000066	.....	.....	
12,250	49,000	.002000	.000067	.....	.....	
12,500	50,000	.002067	.000067	.000400	.000133	
12,750	51,000	.002200	.000133	.....	.....	
13,000	52,000	.002267	.000067	.....	.....	
13,250	53,000	.002333	.000066	.....	.....	
13,500	54,000	.002500	.000167	.....	.....	
13,750	55,000	.002667	.000167	.....	.....	
14,000	56,000	.002867	.000200	.....	.....	
14,250	57,000	.003133	.000266	.....	.....	
14,500	58,000	.003567	.000434	.....	.....	
14,750	59,000	.004033	.000466	.....	.....	
15,000	60,000	.004800	.000767	.....	.....	
15,500	62,000	.006767	.001967	.....	.....	
16,000	64,000	.008733	.001966	.....	.....	
16,500	66,000	.010833	.002100	.....	.....	
17,000	68,000	.012667	.001834	.....	.....	
17,500	70,000	.014900	.002233	.....	.....	
18,000	72,000	.017100	.002200	.....	.....	
18,500	74,000	.019667	.002567	.....	.....	
19,000	76,000	.022167	.002500	.....	.....	
19,500	78,000	.025000	.002833	.....	.....	
20,000	80,000	.0283	.0033	.....	.....	
20,500	82,000	.0317	.0034	.....	.....	
21,000	84,000	.0383	.0066	.....	.....	
21,500	86,000	.0417	.0034	.....	.....	
22,000	88,000	.0467	.0050	.....	.....	
22,500	90,000	.0533	.0066	.....	.....	
23,000	92,000	.0600	.0067	.....	.....	
23,500	94,000	.0767	.0167	.....	.....	
23,740	94.960	.0867	.0100	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	94,960
Elastic limit per square inch of original section	do	40,000
Elongation per inch after rupture	inch	.1000
Elongation per inch under strain at elastic limit	do	.001100
Reduction in diameter at point of rupture	do	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		″.35 from the neck
Character of broken surface		granular, 80 per cent; dull silky spot, 20 per cent
Elongation of inch sections		″.16*, ″.06, ″.08

No. 4325.

Marks, $\frac{10\ W\ R_1\ J}{B\ T_5\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
3,750	15,000	.000433	.000133	.....	.....	
5,000	20,000	.000600	.000167	0.	.....	
6,250	25,000	.000767	.000167	.....	.....	
7,500	30,000	.000933	.000166	0.	.....	
8,000	32,000	.001000	.000067	.....	.....	
8,250	33,000	.001033	.000033	.....	.....	
8,500	34,000	.001067	.000034	.....	.....	
8,750	35,000	.001100	.000033	0.	.....	
9,000	36,000	.001167	.000067	.....	.....	
9,250	37,000	.001200	.000033	.....	.....	
9,500	38,000	.001267	.000067	.....	.....	
9,750	39,000	.001300	.000033	.....	.....	
10,000	40,000	.001367	.000067	.000067	.000067	Elastic limit.
10,250	41,000	.005000	.003633	.....	.....	
10,500	42,000	.007933	.002933	.....	.....	
10,750	43,000	.008367	.000434	.....	.....	
11,000	44,000	.010567	.002200	.....	.....	
11,250	45,000	.011800	.001233	.010167	.010100	
11,500	46,000	.012667	.000867	.....	.....	
11,750	47,000	.013833	.001166	.....	.....	
12,000	48,000	.016000	.002167	.....	.....	
12,250	49,000	.017333	.001333	.....	.....	
12,500	50,000	.019333	.002000	.017600	.007433	
13,000	52,000	.023333	.004000	.....	.....	
13,500	54,000	.028267	.004934	.....	.....	
14,000	56,000	.031667	.003400	.....	.....	
14,500	58,000	.037667	.006000	.....	.....	
15,000	60,000	.0433	.005633	.....	.....	
15,500	62,000	.0500	.0067	.....	.....	
16,000	64,000	.0600	.0100	.....	.....	
16,500	66,000	.0683	.0083	.....	.....	
17,000	68,000	.0833	.0150	.....	.....	
17,500	70,000	.1067	.0234	.....	.....	
18,000	72,000	.1467	.0400	.....	.....	
18,100	72,400	.2000	0.533	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	72,400
Elastic limit per square inch of original section	do	40,000
Elongation per inch after rupture	inch	.2567
Elongation per inch under strain at elastic limit	do	.001367
Reduction in diameter at point of rupture	do	194
Reduction in area after rupture, per centum of original section		57.0
Position of rupture		″.85 from the neck
Character of broken surface		silky
Elongation of inch sections		″.43*, ″.19, ″.15

No. 4326.

Marks, $\frac{10\ W\ R_1\ J}{M\ T_1\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
3,750	15,000	.000433	.000133	.....	.....	
5,000	20,000	.000633	.000200	0.	.....	
6,250	25,000	.000767	.000134	.....	.....	
7,500	30,000	.001000	.000233	0.	.....	
8,000	32,000	.001067	.000067	.....	.....	
8,250	33,000	.001133	.000066	.....	.....	
8,500	34,000	.001167	.000034	.....	.....	
8,750	35,000	.001200	.000033	0.	.....	
9,000	36,000	.001267	.000067	.....	.....	
9,250	37,000	.001333	.000066	.....	.....	Elastic limit.
9,500	38,000	.002000	.000667	.....	.....	
9,750	39,000	.003833	.001833	.....	.....	
10,000	40,000	.007833	.004000	.006600	.006600	
10,250	41,000	.008267	.000434	.....	.....	
10,500	42,000	.009333	.001066	.....	.....	
10,750	43,000	.010667	.001334	.....	.....	
11,000	44,000	.012000	.001333	.....	.....	
11,250	45,000	.013667	.001667	.012133	.005533	
11,500	46,000	.015500	.001833	.....	.....	
11,750	47,000	.017067	.001567	.....	.....	
12,000	48,000	.018000	.000933	.....	.....	
12,250	49,000	.020000	.002000	.....	.....	
12,500	50,000	.022067	.002067	.020333	.008200	
13,000	52,000	.0283	.006233	.....	.....	
13,500	54,000	.0317	.0034	.....	.....	
14,000	56,000	.0367	.0050	.....	.....	
14,500	58,000	.0417	.0050	.....	.....	
15,000	60,000	.0500	.0083	.....	.....	
15,500	62,000	.0567	.0067	.....	.....	
16,000	64,000	.0650	.0083	.....	.....	
16,500	66,000	.0800	.0150	.....	.....	
16,600	66,400	.0833	.0033	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	66,400
Elastic limit per square inch of original section	do...	37,000
Elongation per inch after rupture	inch..	.0933
Elongation per inch under strain at elastic limit	do...	.001333
Reduction in diameter at point of rupture	do...	.054
Reduction in area after rupture, per centum of original section		18.3
Position of rupture		1″.5 from the neck
Character of broken surface		granular; blow hole in fractured surface ″.10 diameter
Elongation of inch sections		″.06, ″.12*, ″.10

No. 4327.

Marks, $^{10\ W\ R_1\ J}_{M\ T_2\ O}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
3,750	15,000	.000467	.000167	.....	.....	
5,000	20,000	.000633	.000166	.....	.....	
6,250	25,000	.000800	.000167	.....	.....	
7,500	30,000	.001000	.000200	0.	.....	
8,000	32,000	.001033	.000033	.....	.....	
8,250	33,000	.001067	.000034	.....	.....	
8,500	34,000	.001133	.000066	.....	.....	
8,750	35,000	.001233	.000100	.000033	.000033	
9,000	36,000	.001300	.000067	.....	.....	
9,250	37,000	.001367	.000067	.....	.....	
9,500	38,000	.001400	.000033	.....	.....	
9,750	39,000	.001433	.000033	.....	.....	Elastic limit.
10,000	40,000	.001633	.000200	.000300	.000267	
10,250	41,000	.002233	.000600	.....	.....	
10,500	42,000	.006600	.004367	.....	.....	
10,750	43,000	.007667	.001067	.....	.....	
11,000	44,000	.008500	.000833	.....	.....	
11,250	45,000	.010333	.001833	.008800	.008500	
11,500	46,000	.012000	.001667	.....	.....	
11,750	47,000	.012900	.000900	.....	.....	
12,000	48,000	.014167	.001267	.....	.....	
12,250	49,000	.015567	.001400	.....	.....	
12,500	50,000	.017933	.002366	.016200	.007400	
13,000	52,000	.021667	.003734	.....	.....	
13,500	54,000	.025000	.003333	.....	.....	
14,000	56,000	.030000	.005000	.....	.....	
14,500	58,000	.035000	.005000	.....	.....	
15,000	60,000	.038333	.003333	.....	.....	
15,500	62,000	.045000	.006667	.....	.....	
16,000	64,000	.051667	.006667	.....	.....	
16,500	66,000	.0600	.008333	.....	.....	
16,980	67,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	67,920
Elastic limit per square inch of original section	do	39,000
Elongation per inch after rupture	inch	.0733
Elongation per inch under strain at elastic limit	do	.001433
Reduction in diameter at point of rupture	do	.025
Reduction in area after rupture, per centum of original section		8.4
Position of rupture		″.15 from the neck
Character of broken surface	granular; fractured surface contained a blow hole ″.08 X ″.30	
Elongation of inch sections		″.08*, ″.06, ″.08

No. 4328.

Marks, $\frac{10\ W\ R\ J}{M\ T_3\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	.....	Initial load.
1,250	5,000	.000133	.000133	0,	.....	
2,500	10,000	.000333	.000200	.....	.....	
3,750	15,000	.000533	.000200	.....	.....	
5,000	20,000	.000733	.000200	.000033	.000033	
6,250	25,000	.000867	.000134	.....	.....	
7,500	30,000	.001033	.000166	.000033	0.	
8,000	32,000	.001100	.000067	.....	.....	
8,250	33,000	.001133	.000033	.....	.....	
8,500	34,000	.001200	.000067	.....	.....	
8,750	35,000	.001233	.000033	.000067	.000034	
9,000	36,000	.001267	.000034	.....	.....	
9,250	37,000	.001300	.000033	.....	.....	
9,500	38,000	.001333	.000033	.....	.....	
9,750	39,000	.001400	.000067	.....	.....	
10,000	40,000	.001467	.000067	.000200	.000133	
10,250	41,000	.001533	.000066	.....	.....	Elastic limit.
10,500	42,000	.001667	.000134	.....	.....	
10,750	43,000	.002200	.000533	.....	.....	
11,000	44,000	.006267	.004067	.....	.....	
11,250	45,000	.009100	.002833	.007467	.007267	
11,500	46,000	.010033	.000933	.....	.....	
11,750	47,000	.010833	.000800	.....	.....	
12,000	48,000	.012933	.002100	.....	.....	
12,250	49,000	.014400	.001467	.....	.....	
12,500	50,000	.016333	.001933	.014367	.006900	
13,000	52,000	.0200	.003667	.....	.....	
13,500	54,000	.0250	.0050	.....	.....	
14,000	56,000	.0283	.0033	.....	.....	
14,500	58,000	.0333	.0050	.....	.....	
15,000	60,000	.0367	.0034	.....	.....	
15,500	62,000	.0433	.0066	.....	.....	
16,000	64,000	.0483	.0050	.....	.....	
16,500	66,000	.0567	.0084	.....	.....	
17,000	68,000	.0683	.0116	.....	.....	
17,500	70,000	.0833	.0150	.....	.....	
17,740	70,960	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	70,960
Elastic limit, per square inch of original section	do...	41,000
Elongation per inch after rupture	inch..	.0967
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.034
Reduction in area after rupture, per centum of original section		11.6
Position of rupture		1″.3 from the neck
Character of broken surface		granular; fractured surface contained two small blow holes
Elongation of inch sections		″.08, ″.12* ″.09

No. 4329.

Marks, $\frac{10\ W\ R\ J}{M\ T_4\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	----	
2,500	10,000	.000333	.000200	----	----	
3,750	15,000	.000567	.000234	----	----	
5,000	20,000	.000733	.000166	0.	----	
6,250	25,000	.000933	.000200	----	----	
7,500	30,000	.001067	.000134	0.	----	
8,000	32,000	.001133	.000066	----	----	
8,250	33,000	.001167	.000034	----	----	
8,500	34,000	.001200	.000033	----	----	
8,750	35,000	.001233	.000033	0.	----	
9,000	36,000	.001267	.000034	----	----	
9,250	37,000	.001300	.000033	----	----	
9,500	38,000	.001333	.000033	----	----	Elastic limit.
9,750	39,000	.001433	.000100	----	----	
10,000	40,000	.001533	.000100	.000233	.000233	
10,250	41,000	.002200	.000667	----	----	
10,500	42,000	.003167	.000967	----	----	
10,750	43,000	.006500	.003333	----	----	
11,000	44,000	.008167	.001667	----	----	
11,250	45,000	.009400	.001233	.007733	.007500	
11,500	46,000	.011033	.001633	----	----	
11,750	47,000	.011933	.000900	----	----	
12,000	48,000	.013333	.001400	----	----	
12,250	49,000	.014733	.001400	----	----	
12,500	50,000	.016733	.002000	.014733	.007000	
13,000	52,000	.0200	.003267	----	----	
13,500	54,000	.0250	.0050	----	----	
14,000	56,000	.0283	.0033	----	----	
14,500	58,000	.0317	.0034	----	----	
15,000	60,000	.0367	.0050	----	----	
15,500	62,000	.0417	.0050	----	----	
16,000	64,000	.0483	.0066	----	----	
16,500	66,000	.0550	.0067	----	----	
16,920	67,680	----	----	----	----	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	67,680
Elastic limit per square inch of original section	do	38,000
Elongation per inch after rupture	inch	.0667
Elongation per inch under strain at elastic limit	do	.001333
Reduction in diameter at point of rupture	do	.024
Reduction in area after rupture, per centum of original section		8.4
Position of rupture		at middle of stem
Character of broken surface		granular, spongy spot at the circumference
Elongation of inch sections		″.05 ″.08* .07

Trunnion Hoop.

No. 4368.

Marks, $^{10\ WR}_{TI}\ ^{TH}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000075	.000075	0.	.....	
2,500	10,000	.000275	.000200	.....	.....	
3,750	15,000	.000425	.000150	.....	.....	
5,000	20,000	.000600	.000175	0.	.....	
6,250	25,000	.000775	.000175	.....	.....	
7,500	30,000	.001000	.000225	.000025	.000025	
8,750	35,000	.001225	.000225	.....	.....	
10,000	40,000	.001450	.000225	.000050	.000025	
10,250	41,000	.001500	.000050	.....	.....	
10,500	42,000	.001550	.000050	.....	.....	
10,750	43,000	.001625	.000075	.....	.....	
11,000	44,000	.001700	.000075	.....	.....	
11,250	45,000	.001750	.000050	.000175	.000125	
11,500	46,000	.001800	.000050	.....	.....	
11,750	47,000	.001825	.000025	.....	.....	{ Elastic limit.
12,000	48,000	.001950	.000125	.....	.....	{ Not well defined.
12,250	49,000	.002025	.000075	.....	.....	
12,500	50,000	.002125	.000100	.000325	.000150	
12,750	51,000	.002225	.000100	.....	.....	
13,000	52,000	.002325	.000100	.....	.....	
13,250	53,000	.002475	.000150	.....	.....	
13,500	54,000	.002675	.000200	.....	.....	
13,750	55,000	.002875	.000200	.000950	.000625	
14,000	56,000	.003750	.000875	.....	.....	
14,500	58,000	.005775	.002025	.....	.....	
15,000	60,000	.007700	.001925	.....	.....	
15,500	62,000	.009500	.001800	.....	.....	
16,000	64,000	.011875	.002375	.....	.....	
16,500	66,000	.014325	.002450	.....	.....	
17,000	68,000	.016250	.001925	.....	.....	
17,500	70,000	.018875	.002625	.....	.....	
18,000	72,000	.021500	.002625	.....	.....	
18,500	74,000	.024750	.003250	.....	.....	
19,000	76,000	.028750	.004000	.....	.....	
19,500	78,000	.032000	.003250	.....	.....	
20,000	80,000	.036875	.004875	.....	.....	
20,500	82,000	.0425	.005625	.....	.....	
21,000	84,000	.0500	.0075	.....	.....	
21,500	86,000	.0575	.0075	.....	.....	
22,000	88,000	.0750	.0175	.....	.....	
22,170	88,680	.0950	.0200	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	88,680
Elastic limit, per square inch of original section, not well defined	do	47,000
Elongation per inch after rupture	inch	.1025
Elongation per inch under strain at elastic limit	do	.001825
Reduction in diameter at point of rupture	do	.064
Reduction in area after rupture, per centum of original section		21.4
Position of rupture		1″.6 from neck
Character of broken surface		silky obliqne, with spots of light-colored metal
Elongation of inch sections		″.04, ″.07, ″.20*, ″.10

No. 4370.

Marks, $\frac{10\ W\ R_1\ TH}{T\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set,	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000250	.000150	.....	.....	
3,750	15,000	.000450	.000200	.....	.....	
5,000	20,000	.000650	.000200	.....	.....	
6,250	25,000	.000825	.000175	.....	.....	
7,500	30,000	.001025	.000200	0.	.....	
8,750	35,000	.001225	.000200	.....	.....	
10,000	40,000	.001450	.000225	.000025	.000025	
10,250	41,000	.001500	.000050	.....	.....	
10,500	42,000	.001525	.000025	.....	.....	
10,750	43,000	.001575	.000050	.....	.....	
11,000	44,000	.001625	.000050	.....	.....	
11,250	45,000	.001675	.000050	.....	.....	
11,500	46,000	.001750	.000075	.....	.....	
11,750	47,000	.001775	.000025	.....	.....	
12,000	48,000	.001825	.000050	.....	.....	
12,250	49,000	.001875	.000050	.....	.....	Elastic limit.
12,500	50,000	.002000	.000125	.000225	.000200	
12,750	51,000	.002100	.000100	.....	.....	
13,000	52,000	.002200	.000100	.....	.....	
13,250	53,000	.002300	.000100	.....	.....	
13,500	54,000	.002450	.000150	.....	.....	
13,750	55,000	.002550	.000100	.000700	.000475	
14,000	56,000	.003175	.000625	.....	.....	
14,250	57,000	.003325	.000150	.....	.....	
14,500	58,000	.004375	.001050	.....	.....	
15,000	60,000	.006250	.001875	.....	.....	
15,500	62,000	.008250	.002000	.....	.....	
16,000	64,000	.010375	.002125	.....	.....	
16,500	66,000	.012675	.002300	.....	.....	
17,000	68,000	.015250	.002575	.....	.....	
17,500	70,000	.018250	.003000	.....	.....	
18,000	72,000	.021250	.003000	.....	.....	
18,500	74,000	.023875	.002625	.....	.....	
19,000	76,000	.027500	.003625	.....	.....	
19,500	78,000	.031250	.003750	.....	.....	
20,000	80,000	.035500	.004250	.....	.....	
20,500	82,000	.039125	.003625	.....	.....	
21,000	84,000	.0475	.008375	.....	.....	
21,500	86,000	.0550	.0075	.....	.....	
22,000	88,000	.0675	.0125	.....	.....	
22,500	90,000	.0800	.0125	.....	.....	
22,740	90,960	.1050	.0250	.....	.....	Tensile strength.

General summary.

Tensile strength per sqnare inch of original section	pounds	90,960
Elastic limit per square inch of original section	do	49,000
Elongation per inch after rupture	inch	.1250
Elongation per inch under strain at elastic limit	do	.001875
Reduction in diameter at point of rupture	do	.084
Reduction in area after rupture, per centum of original section		27.6
Position of rupture		2″ from the neck
Character of broken surface		dull silky; oblique
Elongation of inch sections		″.08, ″.22, ″.11, ″.09

No. 4369.

Marks, $^{10\ W\ R_1\ T\ H}_{T\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	0.	.....	
2,500	10,000	.000300	.000175	.....	.....	
3,750	15,000	.000475	.000175	.....	.....	
5,000	20,000	.000650	.000175	.....	.....	
6,250	25,000	.000800	.000150	.....	.....	
7,500	30,000	.001000	.000200	0.	.....	
8,750	35,000	.001150	.000150	.....	.....	
10,000	40,000	.001300	.000150	0.	.....	
10,250	41,000	.001375	.000075	.....	.....	
10,500	42,000	.001425	.000050	.....	.....	
10,750	43,000	.001475	.000050	.....	.....	
11,000	44,000	.001500	.000025	.....	.....	
11,250	45,000	.001525	.000025	0.	.....	
11,500	46,000	.001575	.000050	.....	.....	
11,750	47,000	.001625	.000050	.....	.....	
12,000	48,000	.001675	.000050	.....	.....	
12,250	49,000	.001750	.000075	.....	.....	
12,500	50,000	.001800	.000050	.....	.....	Elastic limit.
12,750	51,000	.001925	.000125	.....	.....	
13,000	52,000	.002025	.000100	.....	.....	
13,250	53,000	.002225	.000200	.....	.....	
13,500	54,000	.004000	.001775	.....	.....	
13,750	55,000	.005700	.001700	.....	.....	
14,000	56,000	.007500	.001800	.....	.....	
14,500	58,000	.009950	.002450	.....	.....	
15,000	60,000	.011750	.001800	.....	.....	
15,500	62,000	.014250	.002500	.....	.....	
16,000	64,000	.016750	.002500	.....	.....	
16,500	66,000	.019750	.003000	.....	.....	
17,000	68,000	.022500	.002750	.....	.....	
17,500	70,000	.025750	.003250	.....	.....	
18,000	72,000	.029375	.003625	.....	.....	
18,500	74,000	.033500	.004125	.....	.....	
19,000	76,000	.037500	.004000	.....	.....	
19,500	78,000	.0425	.0050	.....	.....	
20,000	80,000	.0500	.0075	.....	.....	
20,500	82,000	.0575	.0075	.....	.....	
21,000	84,000	.0700	.0125	.....	.....	
21,500	86,000	.1000	.0300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	86,000
Elastic limit per square inch of original section	do	50,000
Elongation per inch after rupture	inch	.1175
Elongation per inch under strain at elastic limit	do	.001800
Reduction in diameter at point of rupture	do	.074
Reduction in area after rupture, per centum of original section		24.6
Position of rupture		1″.13 from the neck
Character of broken surface		granular, 55 per cent; dull, silky, 45 per cent
Elongation of inch sections		″.08, ″.22*, ″.10, ″.07

HOOP A_1.

No. 4330.

Marks, $^{10\,W\,R_1\,A_1}_{T\,I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000075	.000075	0.	.....	
2,500	10,000	.000250	.000175	.....	.....	
3,750	15,000	.000375	.000125	.....	.....	
5,000	20,000	.000525	.000150	.....	.....	
6,250	25,000	.000675	.000150	.....	.....	
7,500	30,000	.000875	.000200	—.000025	—.000025	
7,750	31,000	.000900	.000025	.....	.....	Elastic limit.
8,000	32,000	.001000	.000100	.....	.....	
8,250	33,000	.010000	.009000	.....	.....	
8,500	34,000	.013750	.003750	.....	.....	
8,750	35,000	.015000	.001250	.013875	.013900	
9,000	36,000	.016500	.001500	.....	.....	
9,250	37,000	.018000	.001500	.....	.....	
9,500	38,000	.019875	.001875	.....	.....	
9,750	39,000	.021700	.001825	.....	.....	
10,000	40,000	.023750	.002050	.022250	.008375	
10,500	42,000	.0300	.006250	.....	.....	
11,000	44,000	.0350	.0050	.....	.....	
11,500	46,000	.0388	.0138	.....	.....	
12,000	48,000	.0450	.0062	.....	.....	
12,500	50,000	.0525	.0075	.....	.....	
13,000	52,000	.0600	.0075	.....	.....	
13,500	54,000	.0700	.0100	.....	.....	
14,000	56,000	.0850	.0150	.....	.....	
14,500	58,000	.1025	.0175	.....	.....	
15,000	60,000	.1325	.0300	.....	.....	
15,440	61,760	.2050	.0725	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	61,760
Elastic limit per square inch of original section	do	31,000
Elongation per inch after rupture	inch	.2500
Elongation per inch under strain at elastic limit	do	.000900
Reduction in diameter at point of rupture	do	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.75 from the neck
Character of broken surface		silky
Elongation of inch sections		″.17, ″.20, ″.43*, ″.20

No. 4331.

Marks, $^{10\ W\ R_1\ A_1}_{T\ O}$
Diameter, ″.566.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000175	.000175	0.	----------	
2,500	10,000	.000400	.000225	----------	----------	
3,750	15,000	.000550	.000150	----------	----------	
5,000	20,000	.000700	.000150	----------	----------	
6,250	25,000	.000875	.000175	----------	----------	
7,500	30,000	.001050	.000175	.000025	.000025	
7,750	31,000	.001075	.000025	----------	----------	
8,000	32,000	.001125	.000050	----------	----------	
8,250	33,000	.001200	.000075	----------	----------	
8,500	34,000	.001225	.000025	----------	----------	
8,750	35,000	.001275	.000050	.000075	.000050	
9,000	36,000	.001300	.000025	----------	----------	
9,250	37,000	.001350	.000050	----------	----------	Elastic limit.
9,500	38,000	.001450	.000100	----------	----------	
9,750	39,000	.013750	.012300	----------	----------	
10,000	40,000	.015750	.002000	.014175	.014100	
10,500	42,000	.018125	.002375	----------	----------	
11,000	44,000	.021750	.003625	----------	----------	
11,500	46,000	.025500	.003750	----------	----------	
12,000	48,000	.029375	.003875	----------	----------	
12,500	50,000	.033750	.004375	----------	----------	
13,000	52,000	.038750	.005000	----------	----------	
13,500	54,000	.045000	.006250	----------	----------	
14,000	56,000	.051875	.006875	----------	----------	
14,500	58,000	.0625	.010625	----------	----------	
15,000	60,000	.0750	.0125	----------	----------	
15,500	62,000	.0900	.0150	----------	----------	
16,000	64,000	.1125	.0225	----------	----------	
16,500	66,000	.1650	.0525	----------	----------	
16,520	66,080	----------	----------	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	66,080
Elastic limit per square inch of original section	do	37,000
Elongation per inch after rupture	inch	.2000
Elongation per inch under strain at elastic limit	do	.001350
Reduction in diameter at point of rupture	do	.116
Reduction in area after rupture, per centum of original section		36.4
Position of rupture		1″.20 from neck
Character or broken surface		dull, silky
Elongation of inch sections		″.27*, ″.23, ″.17, ″.13

No. 4332.

Marks, $^{10\,W\,R_1\,A_1}_{T\,M}$
Diameter, ″.566.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per sqnare inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000175	.000175	0.	.....	
2,500	10,000	.000300	.000125	.....	.....	
3,750	15,000	.000500	.000200	.....	.....	
5,000	20,000	.000675	.000175	.....	.....	
6,250	25,000	.000850	.000175	.....	.....	
7,500	30,000	.001050	.000200	.000025	.000025	
7,750	31,000	.001100	.000050	.....	.....	
8,000	32,000	.001175	.000075	.....	.....	
8,250	33,000	.001225	.000050	.....	.....	
8,500	34,000	.001250	.000025	.....	.....	
8,750	35,000	.001275	.000025	.000100	.000075	
9,000	36,000	.001325	.000050	.....	.....	Elastic limit.
9,250	37,000	.013750	.012425	.....	.....	
9,500	38,000	.014750	.001000	.....	.....	
9,750	39,000	.015625	.000875	.....	.....	
10,000	40,000	.017500	.001875	.015950	.015850	
10,500	42,000	.020875	.003375	.....	.....	
11,000	44,000	.024375	.003500	.....	.....	
11,500	46,000	.028500	.004125	.....	.....	
12,000	48,000	.033000	.004500	.....	.....	
12,500	50,000	.038250	.005250	.....	.....	
13,000	52,000	.044500	.006250	.....	.....	
13,500	54,000	.051250	.006750	.....	.....	
14,000	56,000	.060000	.008750	.....	.....	
14,500	58,000	.0725	.0125	.....	.....	
15,000	60,000	.0850	.0125	.....	.....	
15,500	62,000	.1100	.0250	.....	.....	
16,000	64,000	.1625	.0525	.....	.....	Tensile strength.

General summary.

Tensile strength, per square inch of original section	pounds	64,000
Elastic limit, per square inch of original section	do	36,000
Elongation per inch after rupture	inch	.2375
Elongation per inch under strain at elastic limit	do	.001325
Reduction in diameter at point of ruptnre	do	.186
Reduction in area after rupture, per centum of original section		54.6
Position of rupture		1″.25 from the neck
Character of broken surface		silky
Elongation of inch sections		″.30*, ″.28 ″.16 ″.11

Hoop C_1.

No. 4358.

Marks, $^{10\ W\ R_1\ C_1}_{T\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	.....	.....	
2,500	10,000	.000300	.000175	.....	.....	
3,750	15,000	.000450	.000150	.....	.....	
5,000	20,000	.000675	.000225	.....	.....	
6,250	25,000	.000825	.000150	.....	.....	
7,500	30,000	.001025	.000200	0.	.....	
8,750	35,000	.001200	.000175	.....	.....	
10,000	40,000	.001400	.000200	.000050	.000050	
10,250	41,000	.001450	.000050	.....	.....	
10,500	42,000	.001525	.000075	.....	.....	
10,750	43,000	.001575	.000050	.....	.....	Elastic limit.
11,000	44,000	.001700	.000125	.....	.....	
11,250	45,000	.001775	.000075	.....	.....	
11,500	46,000	.001950	.000175	.....	.....	
11,750	47,000	.002200	.000250	.....	.....	
12,000	48,000	.003625	.001425	.....	.....	
12,250	49,000	.006250	.002625	.....	.....	
12,500	50,000	.008500	.002250	.....	.....	
13,000	52,000	.010250	.001750	.....	.....	
13,500	54,000	.012125	.001875	.....	.....	
14,000	56,000	.014125	.002050	.....	.....	
14,500	58,000	.016125	.002000	.....	.....	
15,000	60,000	.018700	.002575	.....	.....	
15,500	62,000	.021250	.002550	.....	.....	
16,000	64,000	.0237	.002459	.....	.....	
16,500	66,000	.0275	.0038	.....	.....	
17,000	68,000	.0300	.0025	.....	.....	
17,500	70,000	.0350	.0050	.....	.....	
18,000	72,000	.0400	.0050	.....	.....	
18,500	74,000	.0450	.0050	.....	.....	
19,000	76,000	.0500	.0050	.....	.....	
19,500	78,000	.0550	.0050	.....	.....	
19,980	79,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	79,920
Elastic limit per square inch of original section	do	43,000
Elongation per inch after rupture	inch	.0650
Elongation per inch under strain at elastic limit	do	.001575
Reduction in diameter at point of rupture	do	.044
Reduction in area after rupture, per cent of original section		15.0
Position of rupture		″.75 from the neck
Character of broken surface		granular, 50 per cent; dull silky, with spongy streak, 50 per cent
Elongation of inch sections		″.05, ″.04, ″.06, ″.11*

No. 4356.

Marks, $\frac{10\ W\ R_1\ C_1}{T\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 4".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000175	.000175	0.	.....	
2,500	10,000	.000350	.000175	0.	.....	
3,750	15,000	.000475	.000125	0.	.....	
5,000	20,000	.000650	.000175	0.	.....	
6,250	25,000	.000800	.000150	0.	.....	
7,500	30,000	.001000	.000200	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001375	.000175	.....	.....	
10,250	41,000	.001425	.000050	.....	.....	
10,500	42,000	.001475	.000050	.....	.....	
10,750	43,000	.001525	.000050	.....	.....	Elastic limit.
11,000	44,000	.002100	.000575	.....	.....	
11,250	45,000	.002325	.000225	.....	.....	
11,500	46,000	.002625	.000300	.....	.....	
11,750	47,000	.002825	.000200	.....	.....	
12,000	48,000	.003250	.000425	.....	.....	
12,250	49,000	.005125	.001875	.....	.....	
12,500	50,000	.005525	.000400	.....	.....	
13,000	52,000	.006750	.001225	.....	.....	
13,500	54,000	.010125	.003375	.....	.....	
14,000	56,000	.013250	.003125	.....	.....	
14,500	58,000	.014750	.001500	.....	.....	
15,000	60,000	.019750	.005000	.....	.....	
15,500	62,000	.0225	.002750	.....	.....	
16,000	64,000	.0237	.0012	.....	.....	
16,500	66,000	.0275	.0038	.....	.....	
17,000	68,000	.0300	.0025	.....	.....	
17,500	70,000	.0325	.0025	.....	.....	
18,000	72,000	.0375	.0050	.....	.....	
18,500	74,000	.0425	.0050	.....	.....	
19,000	76,000	.0475	.0050	.....	.....	
19,500	78,000	.0550	.0075	.....	.....	
19,580	78,320	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	78,320
Elastic limit per square inch of original section	do	43,000
Elongation per inch after rupture	inch	.0675
Elongation per inch under strain at elastic limit	do	.001525
Reduction in diameter at point of rupture	do	.034
Reduction in area after rupture, per cent of original section		11.6
Position of rupture		".20 from the neck
Character of broken surface		granular; dull flaky at the circumference
Elongation of inch sections		".03, ".03, ".05, ".16*

No. 4357.

Marks, $\frac{10\ W\ R_1\ C_1}{T\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	.....	.....	
2,500	10,000	.000300	.000175	.....	.....	
3,750	15,000	.000450	.000150	.....	.....	
5,000	20,000	.000650	.000200	.....	.....	
6,250	25,000	.000800	.000150	.....	.....	
7,500	30,000	.001000	.000200	0.	.....	
8,750	35,000	.001200	.000200	.....	.....	
10,000	40,000	.001375	.000175	.000025	.000025	
10,250	41,000	.001425	.000050	.....	.....	
10,500	42,000	.001500	.000075	.....	.....	
10,750	43,000	.001550	.000050	.....	.....	Elastic limit.
11,000	44,000	.001750	.000200	.....	.....	
11,250	45,000	.002925	.001175	.....	.....	
11,500	46,000	.004375	.001450	.....	.....	
11,750	47,000	.007450	.003075	.....	.....	
12,000	48,000	.008500	.001050	.....	.....	
12,250	49,000	.009200	.000700	.....	.....	
12,500	50,000	.010125	.000925	.....	.....	
13,000	52,000	.012025	.001900	.....	.....	
13,500	54,000	.014050	.002025	.....	.....	
14,000	56,000	.016375	.002325	.....	.....	
14,500	58,000	.018000	.001625	.....	.....	
15,000	60,000	.020625	.002625	.....	.....	
15,500	62,000	.0237	.003075	.....	.....	
16,000	64,000	.0275	.0038	.....	.....	
16,500	66,000	.0300	.0025	.....	.....	
17,000	68,000	.0325	.0025	.....	.....	
17,500	70,000	.0375	.0050	.....	.....	
18,000	72,000	.0425	.0050	.....	.....	
18,220	72,880	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	72,880
Elastic limit per square inch of original section	do	43,000
Elongation per inch after rupture	inch	.0550
Elongation per inch under strain at elastic limit	do	.001550
Reduction in diameter at point of rupture	do	.044
Reduction in area after rupture, per cent of original section		15.0
Position of rupture		″.95 from the neck
Character of broken surface		oblique, dull leaden surface with granular streaks
Elongation of inch sections		″.03, ″.04, ″.03, ″.12*

Hoop C_2.

No. 4333.

Marks, $\frac{10\ W\ R_1\ C_2}{T\ I}$.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.
Specimen has a spongy stem.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000150	.000150	0.	.....	
2,500	10,000	.000300	.000150	.....	.....	
3,750	15,000	.000475	.000175	.....	.....	
5,000	20,000	.000625	.000150	.....	.....	
6,250	25,000	.000775	.000150	.....	.....	
7,500	30,000	.001500	.000725	.000475	.000475	Elastic limit below 30,000 pounds per square inch.
7,750	31,000	.001625	.000125	.....	.....	
8,000	32,000	.001800	.000175	.....	.....	
8,250	33,000	.002300	.000500	.....	.....	
8,500	34,000	.002925	.000625	.....	.....	
8,750	35,000	.008125	.005200	.007025	.006550	
9,000	36,000	.012050	.003925	.....	.....	
9,250	37,000	.012925	.000875	.....	.....	
9,500	38,000	.014750	.001825	.....	.....	
9,750	39,000	.015875	.001125	.....	.....	
10,000	40,000	.017675	.001800	.016050	.009025	
10,500	42,000	.0225	.004825	.....	.....	
11,000	44,000	.0262	.0037	.....	.....	
11,500	46,000	.0300	.0038	.....	.....	
12,000	48,000	.0362	.0062	.....	.....	
12,500	50,000	.0400	.0038	.....	.....	
13,000	52,000	.0475	.0075	.....	.....	
13,210	52,840	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	52,840
Elastic limit per square inch of original section		below 30,000 pounds
Elongation per inch after rupture	inch..	.0675
Reduction in diameter at point of rupture	do...	.064
Reduction in area after rupture, per cent of original section		21.4
Position of rupture		″.8 from the neck
Character of broken surface		silky, 20 per cent of area spongy
Elongation of inch sections		″.04, ″.04, ″.05, ″.14*

No. 4335.

Marks, $\overset{10\ W\ R_1\ C_2}{T\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	----	
2,500	10,000	.000300	.000167	----	----	
3,750	15,000	.000433	.000133	----	----	
5,000	20,000	.000600	.000167	0.	----	
6,250	25,000	.000767	.000167	----	----	
7,500	30,000	.001000	.000233	0.	----	
7,750	31,000	.001067	.000067	----	----	Elastic limit.
8,000	32,000	.001167	.000100	----	----	
8,250	33,000	.001400	.000233	----	----	
8,500	34,000	.002500	.001100	----	----	
8,750	35,000	.006000	.003500	.004733	.004733	
9,000	36,000	.009667	.003667	----	----	
9,250	37,000	.010667	.001000	----	----	
9,500	38,000	.012067	.001400	----	----	
9,750	39,000	.013167	.001100	----	----	
10,000	40,000	.014433	.001266	.012900	.008167	
10,500	42,000	.0183	.003867	----	----	
11,000	44,000	.0217	.0034	----	----	
11,500	46,000	.0250	.0033	----	----	
12,000	48,000	.0283	.0033	----	----	
12,500	50,000	.0333	.0050	----	----	
13,000	52,000	.0383	.0050	----	----	
13,500	54,000	.0450	.0067	----	----	
14,000	56,000	.0517	.0067	----	----	
14,500	58,000	.0583	.0066	----	----	
15,000	60,000	.0700	.0117	----	----	
15,410	61,640	----	----	----	----	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	61,640
Elastic limit per square inch of original section	do	31,000
Elongation per inch after rupture	inch	.0967
Elongation per inch under strain at elastic limit	do	.001067
Reduction in diameter at point of rupture	do	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		1″.60 from the neck
Character of broken surface, granular, 45 per cent; dull silky with dark-colored blow hole, 55 per cent		
Elongation of inch sections		″.10, ″.11*, ″.08

No. 4394.

Marks, $\frac{10\ W\ R_1\ C_2}{T\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.001050	.000450	0.	.....	
8,750	35,000	.001225	.000175	.....	.....	
9,000	36,000	.001275	.000050	.....	.....	
9,250	37,000	.001300	.000025	.....	.....	
9,500	38,000	.001325	.000025	.....	.....	
9,750	39,000	.001375	.000050	.....	.....	Elastic limit.
10,000	40,000	.001550	.000175	.000125	.000125	
10,250	41,000	.003250	.001700	.....	.....	
10,500	42,000	.004450	.001200	.....	.....	
10,750	43,000	.006000	.001550	.....	.....	
11,000	44,000	.007925	.001925	.....	.....	
11,250	45,000	.009500	.001575	.....	.....	
11,500	46,000	.013750	.004250	.....	.....	
12,000	48,000	.016125	.002375	.....	.....	
12,500	50,000	.018750	.002625	.....	.....	
13,000	52,000	.021500	.002750	.....	.....	
13,500	54,000	.024500	.003000	.....	.....	
14,000	56,000	.028125	.003625	.....	.....	
14,500	58,000	.032000	.003875	.....	.....	
15,000	60,000	.036500	.004500	.....	.....	
15,500	62,000	.041750	.005250	.....	.....	
15,980	63,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	63,920
Elastic limit per square inch of original section	do	39,000
Elongation per inch after rupture	inch	.0550
Elongation per inch under strain at elastic limit	do	.001375
Reduction in diameter at point of rupture	do	.064
Reduction in area after rupture, per cent of original section		21.4
Position of rupture		at neck
Character of broken surface	silky, spongy; 40 per cent of surface dark-colored. Opened cracks in stem in vicinity of fracture.	
Elongation of inch sections		″.10*, ″.04, ″.04, ″.04

No. 4334.

Marks, $\frac{10\,W\,R_1\,C_2}{T\,M_2}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 4″.
Specimen has a spongy stem.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	0.	.....	
2,500	10,000	.000300	.000175	.....	.....	
3,750	15,000	.000500	.000200	.....	.....	
5,000	20,000	.000700	.000200	.....	.....	
6,250	25,000	.000875	.000175	.....	.....	
6,750	27,000	.000950	.000075	.....	.....	Elastic limit.
7,000	28,000	.003200	.002250	.....	.....	
7,250	29,000	.004375	.001175	.....	.....	
7,500	30,000	.007650	.003275	.006550	.006550	
7,750	31,000	.011150	.003500	.....	.....	
8,000	32,000	.012875	.001725	.....	.....	
8,250	33,000	.014300	.001425	.....	.....	
8,500	34,000	.016000	.001700	.....	.....	
8,750	35,000	.017750	.001750	.016300	.009750	
9,000	36,000	.0212	.003450	.....	.....	
9,500	38,000	.0250	.0038	.....	.....	
10,000	40,000	.0312	.0062	.....	.....	
10,500	42,000	.0350	.0038	.....	.....	
11,000	44,000	.0400	.0050	.....	.....	
11,500	46,000	.0475	.0075	.....	.....	
12,000	48,000	.0600	.0125	.....	.....	
12,500	50,000	.0675	.0075	.....	.....	
13,000	52,000	.0850	.0175	.....	.....	
13,160	52,640	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	52,640
Elastic limit per square inch of original section	do	27,000
Elongation per inch after rupture	inch	.1050
Elongation per inch under strain at elastic limit	do	.000950
Reduction in diameter at point of rupture	do	.074
Reduction in area after rupture, per cent of original section		24.6
Position of rupture		1″.9 from the neck
Character of broken surface		silky; 40 per cent of surface spongy
Elongation of inch sections		″.09, ″.20*, ″.07, ″.06

No. 4336.

Marks, $\frac{10\ W\ R_1\ C_2}{T\ M}$.
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.
Specimen has a spongy stem.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
3,750	15,000	.000500	.000167	.....	.....	
5,000	20,000	.001100	.000600	.000333	.000333	Elastic limit below 20,000 pounds per square inch.
5,250	21,000	.001233	.000133	.....	.....	
5,500	22,000	.001667	.000434	.....	.....	
5,750	23,000	.002033	.000366	.....	.....	
6,000	24,000	.003000	.000967	.....	.....	
6,250	25,000	.004067	.001067	.003233	.002900	
6,500	26,000	.005500	.001433	.....	.....	
6,750	27,000	.006833	.001333	.....	.....	
7,000	28,000	.009333	.002500	.....	.....	
7,250	29,000	.011667	.002334	.....	.....	
7,500	30,000	.015000	.003333	.010533	.007300	
8,000	32,000	.0200	.0050	.....	.....	
8,500	34,000	.0250	.0050	.....	.....	
9,000	36,000	.0317	.0067	.....	.....	
9,100	36,400	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....pounds.. 36,400
Elastic limit per square inch of original section.....below 20,000 pounds
Elongation per inch after rupture.....inch.. .0600
Reduction in diameter at point of rupture.....do... .085
Reduction in area after rupture, per cent of original section..... 27.6
Position of rupture .....″.5 from the neck
Character of broken surface....silky, 45 per cent; balance of surface dark-colored unsound metal, which formed the walls of spongy place in the casting. The metal was spongy at the opposite end of the specimen, with small blowholes along the length of the stem.
Elongation of inch sections.....″.12*, ″.03, ″.03

No. 4395.

Marks, $\frac{10\ W\ R_1\ C_2}{T\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000150	.000150	0.	.....	
2,500	10,000	.000400	.000250	.....	.....	
5,000	20,000	.000700	.000300	.....	.....	
7,500	30,000	.001025	.000325	0.	.....	
8,750	35,000	.001225	.000200	.....	.....	
9,000	36,000	.001275	.000050	.....	.....	
9,250	37,000	.001300	.000025	.....	.....	
9,500	38,000	.001325	.000025	.....	.....	
9,750	39,000	.001375	.000050	.....	.....	
10,000	40,000	.001425	.000050	.000025	.000025	
10,250	41,000	.001450	.000025	.....	.....	
10,500	42,000	.001500	.000050	.....	.....	
10,750	43,000	.001525	.000025	.....	.....	
11,000	44,000	.001550	.000025	.....	.....	
11,250	45,000	.001575	.000025	.....	.....	Elastic limit.
11,500	46,000	.008250	.006675	.....	.....	
11,750	47,000	.009200	.000950	.....	.....	
12,000	48,000	.012500	.003300	.....	.....	
12,250	49,000	.014500	.002000	.....	.....	
12,500	50,000	.016250	.001750	.....	.....	
13,000	52,000	.018250	.002000	.....	.....	
13,500	54,000	.021625	.003375	.....	.....	
14,000	56,000	.024500	.002875	.....	.....	
14,500	58,000	.027900	.003400	.....	.....	
15,000	60,000	.032000	.004100	.....	.....	
15,500	62,000	.035300	.003300	.....	.....	
16,000	64,000	.0425	.0072	.....	.....	
16,500	66,000	.0475	.0050	.....	.....	
17,000	68,000	.0525	.0050	.....	.....	
17,500	70,000	.0600	.0075	.....	.....	
18,000	72,000	.0700	.0100	.....	.....	
18,500	74,000	.0775	.0075	.....	.....	
19,000	76,000	.1000	.0225	.....	.....	
19,500	78,000	.1275	.0275	.....	.....	
19,710	78,840	.1700	.0425	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	78,840
Elastic limit per square inch of original section	do	45,000
Elongation per inch after rupture	inch	.2125
Elongation per inch under strain at elastic limit	do	.001575
Reduction in diameter at point of rupture	do	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		″.75 from the neck
Character of broken surface		silky, oblique
Elongation of inch sections		″.13, ″.17, ″.22, ″.33*

No. 4393.

Marks, $^{10\ W\ R_1\ C_2}_{T\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000150	.000150	0.	.....	
2,500	10,000	.000325	.000175	.....	.....	
5,000	20,000	.000725	.000400	.....	.....	
7,500	30,000	.001050	.000325	0.	.....	
8,750	35,000	.001250	.000200	.....	.....	
9,000	36,000	.001275	.000025	.....	.....	
9,250	37,000	.001300	.000025	.....	.....	
9,500	38,000	.001325	.000025	.....	.....	
9,750	39,000	.001375	.000050	.....	.....	
10,000	40,000	.001425	.000050	0.	.....	
10,250	41,000	.001475	.000050	.....	.....	
10,500	42,000	.001500	.000025	.....	.....	
10,750	43,000	.001525	.000025	.....	.....	
11,000	44,000	.001550	.000025	.....	.....	
11,250	45,000	.001575	.000025	.....	.....	Elastic limit.
11,500	46,000	.007500	.005925	.....	.....	
11,750	47,000	.009625	.002125	.....	.....	
12,000	48,000	.013125	.003500	.....	.....	
12,250	49,000	.014500	.001375	.....	.....	
12,500	50,000	.015500	.001000	.....	.....	
13,000	52,000	.018250	.002750	.....	.....	
13,500	54,000	.020750	.002500	.....	.....	
14,000	56,000	.023500	.002750	.....	.....	
14,500	58,000	.026500	.003000	.....	.....	
15,000	60,000	.030000	.003500	.....	.....	
15,500	62,000	.033625	.003625	.....	.....	
16,000	64,000	.038750	.005125	.....	.....	
16,500	66,000	.0425	.003750	.....	.....	
17,000	68,000	.0500	.0075	.....	.....	
17,500	70,000	.0550	.0050	.....	.....	
18,000	72,000	.0625	.0075	.....	.....	
18,500	74,000	.0725	.0100	.....	.....	
19,000	76,000	.0850	.0125	.....	.....	
19,500	78,000	.1050	.0200	.....	.....	
20,000	80,000	.2000	.0950	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	80,000
Elastic limit per square inch of original section	do	45,000
Elongation per inch after rupture	inch	.1550
Elongation per inch under strain at elastic limit	do	.001575
Reduction in diameter at point of rupture	do	.084
Reduction in area after rupture, per cent of original section		27.6
Position of rupture		1″.7 from the neck
Character of broken surface		silky, oblique; opened cracks in surface of stem
Elongation of inch sections		″.10, ″.15, ″.23, ″.14

Hoop C_3.

No. 4337.

Marks, $\frac{10\ W\ R_1\ C_3}{T\ I}$
Diameter, ".563.
Sectional area, .25 square inch.
Gauged length, 3.
Specimen has spongy stem.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000200	.000200	0.	.....	
2,500	10,000	.000367	.000167	.....	.....	
3,750	15,000	.000600	.000233	.....	.....	
5,000	20,000	.000733	.000133	0.	.....	
6,250	25,000	.000967	.000234	.....	.....	
7,500	30,000	.001200	.000233	.000067	.000067	
7,750	31,000	.001267	.000067	.....	.....	
8,000	32,000	.001333	.000066	.....	.....	
8,250	33,000	.001367	.000034	.....	.....	
8,500	34,000	.001400	.000033	.....	.....	
8,750	35,000	.001433	.000033	.000167	.000100	
9,000	36,000	.001467	.000034	.....	.....	
9,250	37,000	.001533	.000066	.....	.....	
9,500	38,000	.001600	.000067	.....	.....	Elastic limit.
9,750	39,000	.001700	.000100	.....	.....	
10,000	40,000	.001833	.000133	.000333	.000166	
10,250	41,000	.002000	.000167	.....	.....	
10,500	42,000	.002100	.000100	.....	.....	
10,750	43,000	.002300	.000200	.....	.....	
11,000	44,000	.002500	.000200	.....	.....	
11,250	45,000	.002700	.000200	.001000	.000667	
11,500	46,000	.003067	.000367	.....	.....	
11,750	47,000	.003267	.000200	.....	.....	
12,000	48,000	.003600	.000333	.....	.....	
12,250	49,000	.003900	.000300	.....	.....	
12,500	50,000	.004733	.000833	.002733	.001733	
13,000	52,000	.006567	.001834	.....	.....	
13,500	54,000	.008033	.001466	.....	.....	
14,000	56,000	.009900	.001867	.....	.....	
14,500	58,000	.011667	.001767	.....	.....	
15,000	60,000	.013733	.002066	.....	.....	
15,500	62,000	.016000	.002267	.....	.....	
16,000	64,000	.019167	.003167	.....	.....	
16,500	66,000	.021333	.002166	.....	.....	
17,000	68,000	.023733	.002400	.....	.....	
17,410	69,640	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	69,640
Elastic limit per square inch of original section	do	38,000
Elongation per inch after rupture	inch	.0267
Elongation per inch under strain at elastic limit	do	.001600
Reduction in diameter at point of rupture	do	.013
Reduction in area after rupture, per cent of original section		4.8
Position of rupture		".3 from the neck
Character of broken surface		granular; 10 per cent of surface occupied by dark-colored spongy spots
Elongation of inch sections		".01, ".03, ".04*

No. 4386.

Marks, $^{10\ W\ R_1\ C_3}_{T\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000700	.000400	.....	.....	
7,500	30,000	.001025	.000325	0.	.....	
8,750	35,000	.001200	.000175	.....	.....	
10,000	40,000	.001375	.000175	.000025	.000025	
10,250	41,000	.001425	.000050	.....	.....	
10,500	42,000	.001475	.000050	.....	.....	Elastic limit.
		.012500	.011025	.....	.....	
10,750	43,000	.014200	.001700	.....	.....	
11,000	44,000	.016750	.002550	.....	.....	
11,250	45,000	.020875	.004125	.....	.....	
11,500	46,000	.022450	.001575	.....	.....	
11,750	47,000	.023750	.001300	.....	.....	
12,000	48,000	.025250	.001500	.....	.....	
12,250	49,000	.027250	.002000	.....	.....	
12,500	50,000	.029450	.002200	.....	.....	
13,000	52,000	.0325	.003050	.....	.....	
13,500	54,000	.0400	.0075	.....	.....	
14,000	56,000	.0450	.0050	.....	.....	
14,500	58,000	.0500	.0050	.....	.....	
15,000	60,000	.0600	.0100	.....	.....	
15,500	62,000	.0725	.0125	.....	.....	
16,000	64,000	.0825	.0100	.....	.....	
16,500	66,000	.1050	.0225	.....	.....	
17,000	68,000	.1375	.0325	.....	.....	
17,180	68,720	.1875	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	68,720
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.2150
Elongation per inch under strain at elastic limit	do...	.001475
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		2″.15 from the neck
Character of broken surface		silky, irregular oblique; opened cracks in surface of stem
Elongation of inch sections		″.19, ″.33*, ″.19, ″.15

No. 4338.

Marks, $\frac{10\ W\ R_1\ C_3}{T\ O}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000200	.000133	.....	.....	
3,750	15,000	.000367	.000167	.....	.....	
5,000	20,000	.000533	.000166	0.	.....	
6,250	25,000	.000700	.000167	.....	.....	
7,500	30,000	.000933	.000233	0.	.....	
8,750	35,000	.001100	.000167	0.	.....	
9,000	36,000	.001167	.000067	.....	.....	
9,250	37,000	.001267	.000100	.....	.....	
9,500	38,000	.001300	.000033	.....	.....	
9,750	39,000	.001333	.000033	.....	.....	
10,000	40,000	.001367	.000034	.000033	.000033	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001533	.000100	.....	.....	
11,000	44,000	.001633	.000100	.....	.....	
11,250	45,000	.001700	.000067	.000033	0.	
11,500	46,000	.001733	.000033	.....	.....	
11,750	47,000	.001800	.000067	.....	.....	Elastic limit.
12,000	48,000	.001933	.000133	.....	.....	
12,250	49,000	.002033	.000100	.....	.....	
12,500	50,000	.002200	.000167	.000300	.000267	
12,750	51,000	.002400	.000200	.....	.....	
13,000	52,000	.002667	.000267	.....	.....	
13,250	53,000	.002967	.000300	.....	.....	
13,500	54,000	.004000	.001033	.....	.....	
14,000	56,000	.005567	.001567	.....	.....	
14,500	58,000	.007267	.001700	.....	.....	
15,000	60,000	.009500	.002233	.....	.....	
15,500	62,000	.011400	.001900	.....	.....	
16,000	64,000	.013667	.002267	.....	.....	
16,320	65,280	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	65,280
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.0200
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.015
Reduction in area after rupture, per cent of original section		4.8
Position of rupture		1″ from the neck
Character of broken surface	granular; 20 per cent of surface occupied by spongy metal	
Elongation of inch sections		″.01, ″.01, ″.04*

No. 4387.

Marks, $\frac{10\ W\ R_1\ C_3}{T\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	0.	.....	
2,500	10,000	.000300	.000175	.....	.....	
5,000	20,000	.000575	.000275	.....	.....	
7,500	30,000	.000925	.000350	0.	.....	
8,750	35,000	.001100	.000175	.....	.....	
10,000	40,000	.001275	.000175	0.	.....	
10,250	41,000	.001300	.000025	.....	.....	Elastic limit.
10,500	42,000	.013500	.012200	.....	.....	
10,750	43,000	.015375	.001875	.....	.....	
11,000	44,000	.018950	.003575	.....	.....	
11,250	45,000	.019950	.001000	.....	.....	
11,500	46,000	.021675	.001725	.....	.....	
11,750	47,000	.023050	.001375	.....	.....	
12,000	48,000	.025000	.001950	.....	.....	
12,250	49,000	.026875	.001875	.....	.....	
12,500	50,000	.029125	.002250	.....	.....	
13,000	52,000	.0325	.003375	.....	.....	
13,500	54,000	.0375	.0050	.....	.....	
14,000	56,000	.0450	.0075	.....	.....	
14,500	58,000	.0500	.0050	.....	.....	
15,000	60,000	.0575	.0075	.....	.....	
15,500	62,000	.0700	.0125	.....	.....	
16,000	64,000	.0800	.0100	.....	.....	
16,500	66,000	.1000	.0200	.....	.....	
17,000	68,000	.1250	.0250	.....	.....	
17,360	69,440	.1950	.0700	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	69,440
Elastic limit per square inch of original section	do	41,000
Elongation per inch after rupture	inch	.2450
Elongation per inch under strain at elastic limit	do	.001300
Reduction in diameter at point of rupture	do	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″.60 from the neck
Character of broken surface		silky, irregular, oblique
Elongation of inch sections		″.40*, ″.24, ″.20, ″.14

No. 4339.

Marks, $^{10\ W\ R_1\ C_3}_{T\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″,
Specimen has spongy stem.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000200	.000200	0.	.....	
2,500	10,000	.000400	.000200	.....	.....	
3,750	15,000	.000600	.000200	.....	.....	
5,000	20,000	.000833	.000233	.000033	.000033	
6,250	25,000	.001067	.000234	.....	.....	
7,500	30,000	.001500	.000433	.000400	.000367	Elastic limit below 30,000 pounds per square inch.
7,750	31,000	.001667	.000167	.....	.....	
8,000	32,000	.001767	.000100	.....	.....	
8,250	33,000	.001833	.000066	.....	.....	
8,500	34,000	.002000	.000167	.....	.....	
8,750	35,000	.002100	.000100	.000967	.000567	
9,000	36,000	.002400	.000300	.....	.....	
9,250	37,000	.002600	.000267	.....	.....	
9,500	38,000	.002867	.000267	.....	.....	
9,750	39,000	.003100	.000233	.....	.....	
10,000	40,000	.003267	.000167	.001933	.000966	
10,500	42,000	.003833	.000566	.....	.....	
11,000	44,000	.004733	.000900	.....	.....	
11,500	46,000	.005833	.001100	.....	.....	
12,000	48,000	.007500	.001667	.....	.....	
12,500	50,000	.009333	.001833	.....	.....	
13,000	52,000	.011500	.002167	.....	.....	
13,500	54,000	.013667	.002167	.....	.....	
14,000	56,000	.016333	.002666	.....	.....	
14,500	58,000	.020000	.003667	.....	.....	
14,610	58,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section ..... pounds.. 58,440
Elastic limit per square inch of original section ..... below 30,00 pounds
Elongation per inch after rupture ..... inch.. .0267
Reduction in diameter at point of rupture ..... do... .014
Reduction in area after rupture, per cent of original section 4.8
Position of rupture ..... at middle of stem
Character of broken surface ..... granular, 45 per cent; dark spongy, 55 per cent
Elongation of inch sections ..... ″.00, ″.08*, ″.00

No. 4388.

Marks, $\frac{10\ W\ R_1\ C_3}{T\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	0.	.....	
2,500	10,000	.000300	.000175	.....	.....	
5,000	20,000	.000675	.000375	.....	.....	
7,500	30,000	.001025	.000350	0.	.....	
8,750	35,000	.001250	.000225	.....	.....	
9,000	36,000	.001275	.000025	.....	.....	
9,250	37,000	.001325	.000050	.....	.....	Elastic limit.
9,500	38,000	.006875	.005550	.....	.....	
9,750	39,000	.010875	.004000	.....	.....	
10,000	40,000	.013750	.002875	.....	.....	
10,250	41,000	.017750	.004000	.....	.....	
10,500	42,000	.019500	.001750	.....	.....	
10,750	43,000	.020750	.001250	.....	.....	
11,000	44,000	.022750	.002000	.....	.....	
11,250	45,000	.024750	.002000	.....	.....	
11,500	46,000	.027000	.002250	.....	.....	
11,750	47,000	.028500	.001500	.....	.....	
12,000	48,000	.031250	.002750	.....	.....	
12,250	49,000	.033125	.001875	.....	.....	
12,500	50,000	.036250	.003125	.....	.....	
13,000	52,000	.041750	.005500	.....	.....	
13,500	54,000	.0500	.008250	.....	.....	
14,000	56,000	.0550	.0050	.....	.....	
14,500	58,000	.0675	.0125	.....	.....	
15,000	60,000	.0800	.0125	.....	.....	
15,500	62,000	.1000	.0200	.....	.....	
16,000	64,000	.1350	.0350	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	64,000
Elastic limit per square inch of original section	do	37,000
Elongation per inch after rupture	inch	.1450
Elongation per inch under strain at elastic limit	do	.001325
Reduction in diameter at point of rupture	do	.074
Reduction in area after rupture, per cent of original section		24.6
Position of rupture		″.25 from the neck
Character of broken surface		silky, oblique; contains spongy spot. Opened cracks in surface of stem
Elongation of inch sections		″.10, ″.13, ″.14, ″.21*

Hoop C_5.

No. 4367.

Marks, $^{10}\ \underset{T\ I}{W\ R_1\ C_5}$

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	.....	.....	
2,500	10,000	.000300	.000175	.....	.....	
3,750	15,000	.000450	.000150	.....	.....	
5,000	20,000	.000650	.000200	.....	.....	
6,250	25,000	.000775	.000125	.....	.....	
7,500	30,000	.000975	.000200	0.	.....	
8,750	35,000	.001175	.000200	.....	.....	
10,000	40,000	.001300	.000125	0.	.....	
11,250	45,000	.001475	.000175	.....	.....	
12,500	50,000	.001700	.000225	0.	.....	
12,750	51,000	.001750	.000050	.....	.....	
13,000	52,000	.001800	.000050	.....	.....	Elastic limit.
13,250	53,000	.001925	.000125	.....	.....	
13,500	54,000	.002050	.000125	.....	.....	
13,750	55,000	.002150	.000100	.....	.....	
14,000	56,000	.002525	.000375	.....	.....	
14,250	57,000	.002775	.000250	.....	.....	
14,500	58,000	.007000	.004225	.....	.....	
14,750	59,000	.008000	.001000	.....	.....	
15,000	60,000	.008500	.000500	.....	.....	
15,500	62,000	.009875	.001375	.....	.....	
16,000	64,000	.011200	.001325	.....	.....	
16,500	66,000	.012400	.001200	.....	.....	
17,000	68,000	.013875	.001475	.....	.....	
17,500	70,000	.015275	.001400	.....	.....	
18,000	72,000	.017000	.001725	.....	.....	
18,500	74,000	.018750	.001750	.....	.....	
19,000	76,000	.020575	.001825	.....	.....	
19,500	78,000	.022500	.001925	.....	.....	
20,000	80,000	.024500	.002000	.....	.....	
20,500	82,000	.026500	.002000	.....	.....	
21,000	84,000	.028500	.002000	.....	.....	
21,500	86,000	.031250	.002750	.....	.....	
22,000	88,000	.0325	.001250	.....	.....	
22,500	90,000	.0375	.0050	.....	.....	
23,000	92,000	.0425	.0050	.....	.....	
23,500	94,000	.0450	.0025	.....	.....	
24,000	96,000	.0500	.0050	.....	.....	
24,500	98,000	.0550	.0050	.....	.....	
25,000	100,000	.0600	.0050	.....	.....	
25,500	102,000	.0725	.0125	.....	.....	
26,000	104,000	.0825	.0100	.....	.....	
26,470	105,880	.1250	.0425	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	105,880
Elastic limit per square inch of original section	do	52,000
Elongation per inch after rupture	inch	.1575
Elongation per inch under strain at elastic limit	do	.001800
Reduction in diameter at point of rupture	do	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		″.9 from the neck
Character of broken surface		fine silky
Elongation of inch sections		″.09, ″.11, ″.14, ″.29

No. 4379.

Marks, $^{10\ W\ R_1\ C_5}_{T_2\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000275	.000175	.....	.....	
5,000	20,000	.000650	.000375	.....	.....	
7,500	30,000	.000975	.000325	0.	.....	
8,750	35,000	.001175	.000200	.....	.....	
9,000	36,000	.001200	.000025	.....	.....	
9,250	37,000	.001225	.000025	.....	.....	
9,500	38,000	.001275	.000050	.....	.....	
9,750	39,000	.001300	.000025	.....	.....	
10,000	40,000	.001325	.000025	0.	.....	
10,250	41,000	.001375	.000050	.....	.....	
10,500	42,000	.001425	.000050	.....	.....	
10,750	43,000	.001450	.000025	.....	.....	Elastic limit.
11,000	44,000	.001525	.000075	.....	.....	
11,250	45,000	.006875	.005350	.....	.....	
11,500	46,000	.008050	.001175	.....	.....	
11,750	47,000	.013500	.005450	.....	.....	
12,000	48,000	.014000	.000500	.....	.....	
12,250	49,000	.014750	.000750	.....	.....	
12,500	50,000	.015950	.001200	.....	.....	
12,750	51,000	.017000	.001050	.....	.....	
13,000	52,000	.018000	.001000	.....	.....	
13,500	54,000	.020450	.002450	.....	.....	
14,000	56,000	.022875	.002425	.....	.....	
14,500	58,000	.025500	.002625	.....	.....	
15,000	60,000	.0275	.0020	.....	.....	
15,500	62,000	.0300	.0025	.....	.....	
16,000	64,000	.0350	.0050	.....	.....	
16,500	66,000	.0425	.0075	.....	.....	
17,000	68,000	.0475	.0050	.....	.....	
17,500	70,000	.0525	.0050	.....	.....	
18,000	72,000	.0575	.0050	.....	.....	
18,500	74,000	.0650	.0075	.....	.....	
19,000	76,000	.0750	.0100	.....	.....	
19,500	78,000	.0875	.0125	.....	.....	
20,000	80,000	.1000	.0125	.....	.....	
20,420	81,680	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	81,680
Elastic limit per square inch of original section	do	43,000
Elongation per inch after rupture	inch	.1400
Elongation per inch under strain at elastic limit	do	.001450
Reduction in diameter at point of rupture	do	.054
Reduction in area after rupture, per cent of original section		18.3

Position of rupture ..... ″.75 from the neck
Character of broken surface ..... granular, flaky, radiating from a spongy spot at the circumference. Opened a series of cracks along the surface of the stem.
Elongation of inch sections ..... ″.11, ″.12, ″.14, ″.19*

No. 4405.

Marks, $\frac{10\ W\ R_1\ C_5}{T_2\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000075	.000075	0.	.....	
2,500	10,000	.000250	.000175	.....	.....	
3,750	15,000	.000400	.000150	.....	.....	
5,000	20,000	.000575	.000175	.....	.....	
6,250	25,000	.000750	.000175	.....	.....	
7,500	30,000	.000950	.000200	0.	.....	
7,750	31,000	.001000	.000050	.....	.....	Elastic limit.
8,000	32,000	.001150	.000150	.....	.....	
8,250	33,000	.003200	.002050	.....	.....	
8,500	34,000	.006625	.003425	.....	.....	
8,750	35,000	.008800	.002175	.....	.....	
9,000	36,000	.009925	.001125	.....	.....	
9,250	37,000	.011250	.001325	.....	.....	
9,500	38,000	.012675	.001425	.....	.....	
9,750	39,000	.013750	.001075	.....	.....	
10,000	40,000	.015250	.001500	.....	.....	
10,250	41,000	.016625	.001375	.....	.....	
10,500	42,000	.018125	.001500	.....	.....	
10,750	43,000	.019500	.001375	.....	.....	
11,000	44,000	.021250	.001750	.....	.....	
11,250	45,000	.022750	.001500	.....	.....	
11,500	46,000	.024625	.001875	.....	.....	
11,750	47,000	.026250	.001625	.....	.....	
12,000	48,000	.028500	.002250	.....	.....	
12,250	49,000	.030250	.001750	.....	.....	
12,500	50,000	.033000	.002750	.....	.....	
13,000	52,000	.0375	.0045	.....	.....	
13,500	54,000	.0450	.0075	.....	.....	
14,000	56,000	.0525	.0075	.....	.....	
14,500	58,000	.0650	.0125	.....	.....	
15,000	60,000	.0750	.0100	.....	.....	
15,540	62,160	.....	.....	.....	.....	Tensile strength.

General summary

Tensile strength per square inch of original section	pounds..	62,160
Elastic limit per square inch of original section	do...	31,000
Elongation per inch after rupture	inch..	.0900
Elongation per inch under strain at elastic limit	do...	.001000
Reduction in diameter at point of rupture	do...	.044
Reduction in area after rupture, per cent of original section		15.0
Position of rupture		1″.25 from the neck
Character of broken surface		85 per cent granular, 15 per cent silky, with a spongy line of metal
Elongation of inch sections		″.09, ″.11, ″.08, ″.08

No. 4502.

Marks, $^{10\ W\ R\ C_5}_{T_5\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000075	.000075	0.	----	
2,500	10,000	.000275	.000200	----	----	
3,750	15,000	.000450	.000175	----	----	
5,000	20,000	.000600	.000150	----	----	
6,250	25,000	.000800	.000200	----	----	
7,500	30,000	.000975	.000175	0.	----	
7,750	31,000	.001000	.000025	----	----	
8,000	32,000	.001025	.000025	----	----	
8,250	33,000	.001050	.000025	----	----	
8,500	34,000	.001075	.000025	----	----	
8,750	35,000	.001100	.000025	0.	----	
9,000	36,000	.001150	.000050	----	----	
9,250	37,000	.001200	.000050	----	----	
9,500	38,000	.001225	.000025	----	----	
9,750	39,000	.001250	.000025	----	----	
10,000	40,000	.001275	.000025	.000025	.000025	
10,250	41,000	.001300	.000025	----	----	
10,500	42,000	.001325	.000025	----	----	
10,750	43,000	.001375	.000050	----	----	Elastic limit.
11,000	44,000	.001500	.000125	----	----	
11,250	45,000	.021250	.019750	----	----	
11,500	46,000	.022275	.001025	----	----	
11,750	47,000	.023750	.001475	----	----	
12,000	48,000	.026000	.002250	----	----	
12,250	49,000	.028000	.002000	----	----	
12,500	50,000	.030875	.002875	----	----	
13,000	52,000	.0375	.006625	----	----	
13,500	54,000	.0425	.0050	----	----	
14,000	56,000	.0500	.0075	----	----	
14,500	58,000	.0550	.0050	----	----	
15,000	60,000	.0675	.0125	----	----	
15,500	62,000	.0775	.0100	----	----	
16,000	64,000	.1000	.0225	----	----	
16,500	66,000	.1300	.0300	----	----	
16,860	67,440	.2225	.0925	----	----	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	67,440
Elastic limit per square inch of original section	do	43,000
Elongation per inch after rupture	inch	.2450
Elongation per inch under strain at elastic limit	do	.001375
Reduction in diameter at point of rupture	do	.094
Reduction in area after rupture, per cent of original section		30.6
Position of rupture		2″.15 from the neck
Character of broken surface....granular, 60 per cent; silky, 40 per cent. Opened cracks in surface of stem.		
Elongation of inch sections		″.22, ″.25, ″.32*, ″.19

No. 4365.

Marks, $\frac{10\ W\ R_1\ C_5}{T\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000075	.000075	----------	----------	
2,500	10,000	.000275	.000200	----------	----------	
3,750	15,000	.000475	.000200	----------	----------	
5,000	20,000	.000600	.000125	0.	----------	
6,250	25,000	.000775	.000175	----------	----------	
7,500	30,000	.000925	.000150	0.	----------	
8,750	35,000	.001075	.000150	----------	----------	
10,000	40,000	.001275	.000200	0.	----------	
11,250	45,000	.001475	.000200	----------	----------	
12,500	50,000	.001675	.000200	0.	----------	
12,750	51,000	.001725	.000050	----------	----------	
13,000	52,000	.001775	.000050	----------	----------	Elastic limit.
13,250	53,000	.001925	.000150	----------	----------	
13,500	54,000	.002075	.000150	----------	----------	
13,750	55,000	.002375	.000300	----------	----------	
14,000	56,000	.003550	.001175	----------	----------	
14,250	57,000	.004750	.001200	----------	----------	
14,500	58,000	.006500	.001750	----------	----------	
14,750	59,000	.007750	.001250	----------	----------	
15,000	60,000	.008625	.000875	----------	----------	
15,500	62,000	.009550	.000925	----------	----------	
16,000	64,000	.011125	.001575	----------	----------	
16,500	66,000	.012250	.001125	----------	----------	
17,000	68,000	.013525	.001275	----------	----------	
17,500	70,000	.015500	.001975	----------	----------	
18,000	72,000	.0175	.0020	----------	----------	
18,500	74,000	.0200	.0025	----------	----------	
19,000	76,000	.0225	.0025	----------	----------	
19,500	78,000	.0237	.0012	----------	----------	
20,000	80,000	.0250	.0013	----------	----------	
20,500	82,000	.0262	.0012	----------	----------	
21,000	84,000	.0275	.0013	----------	----------	
21,500	86,000	.0300	.0025	----------	----------	
22,000	88,000	.0312	.0012	----------	----------	
22,500	90,000	.0325	.0013	----------	----------	
22,930	91,720	----------	----------	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	91,720
Elastic limit per square inch of original section	do	52,000
Elongation per inch after rupture	inch	.0350
Elongation per inch under strain at elastic limit	do	.001775
Reduction in diameter at point of rupture	do	.014
Reduction in area after rupture, per cent of original section		4.8
Position of rupture		″.15 from the neck
Character of broken surface		granular; small spongy spots near the circumference
Elongation of inch sections		″.04*, ″.03, ″.04, ″.03

No. 4404.

Marks, $^{10\ W\ R_1\ C_5}_{T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	0.	.....	
2,500	10,000	.000300	.000175	.....	.....	
3,750	15,000	.000475	.000175	.....	.....	
5,000	20,000	.000650	.000175	.....	.....	
6,250	25,000	.000825	.000175	.....	.....	
7,500	30,000	.001050	.000225	.000025	.000025	
7,750	31,000	.001125	.000075	.....	.....	
8,000	32,000	.001200	.000075	.....	.....	
8,250	33,000	.001250	.000050	.....	.....	Elastic limit.
8,500	34,000	.001350	.000100	.....	.....	
8,750	35,000	.002800	.001450	.....	.....	
9,000	36,000	.005275	.002475	.....	.....	
9,250	37,000	.006250	.000975	.....	.....	
9,500	38,000	.007375	.001125	.....	.....	
9,750	39,000	.008200	.000825	.....	.....	
10,000	40,000	.009875	.001675	.....	.....	
10,250	41,000	.010750	.000875	.....	.....	
10,500	42,000	.012375	.001625	.....	.....	
10,750	43,000	.013400	.001025	.....	.....	
11,000	44,000	.014925	.001525	.....	.....	
11,250	45,000	.016200	.001275	.....	.....	
11,500	46,000	.017625	.001425	.....	.....	
11,750	47,000	.019000	.001375	.....	.....	
12,000	48,000	.020500	.001500	.....	.....	
12,250	49,000	.021875	.001375	.....	.....	
12,500	50,000	.023950	.002075	.....	.....	
12,750	51,000	.025250	.001300	.....	.....	
13,000	52,000	.027525	.002275	.....	.....	
13,500	54,000	.0300	.002475	.....	.....	
14,000	56,000	.0375	.0075	.....	.....	
14,500	58,000	.0450	.0075	.....	.....	
15,000	60,000	.0500	.0050	.....	.....	
15,500	62,000	.0575	.0075	.....	.....	
16,000	64,000	.0675	.0100	.....	.....	
16,500	66,000	.0750	.0075	.....	.....	
17,000	68,000	.0950	.0200	.....	.....	
17,260	69,040	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	69,040
Elastic limit per square inch of original section	do	33,000
Elongation per inch after rupture	inch	.1175
Elongation per inch under strain at elastic limit	do	.001250
Reduction in diameter at point of rupture	do	.064
Reduction in area after rupture, per cent of original section		21.4
Position of rupture		1″.17 from the neck
Character of broken surface		granular; opened cracks in surface of stem in vicinity of place of rupture.
Elongation of inch sections		″.20*, ″.09, ″.08, ″.10

No. 4381.

Marks, $^{10\ W\ R_1\ C_5}_{T_2\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	0.	.....	
2,500	10.000	.000300	.000175	.....	.....	
5,000	20,000	.000700	.000400	.....	.....	
7,500	30,000	.001025	.000325	.000025	.000025	
8,750	35,000	.001200	.000175	.....	.....	
9,000	36,000	.001225	.000025	.....	.....	
9,250	37,000	.001250	.000025	.....	.....	
9,500	38,000	.001275	.000025	.....	.....	
9,750	39,000	.001300	.000025	.....	.....	
10,000	40,000	.001350	.000050	.000025	0.	
10,250	41,000	.001400	.000050	.....	.....	
10,500	42,000	.001450	.000050	.....	.....	
10,750	43,000	.001475	.000025	.....	.....	
11,000	44,000	.001500	.000025	.....	.....	
11,250	45,000	.001550	.000050	.....	.....	
11,500	46,000	.001575	.000025	.....	.....	
11,750	47,000	.001600	.000025	.....	.....	Elastic limit.
12,000	48,000	.001675	.000075	.....	.....	
12,250	49,000	.001750	.000075	.....	.....	
12,500	50,000	.008375	.006625	.....	.....	
12,750	51,000	.011200	.002825	.....	.....	
13,000	52,000	.013000	.001800	.....	.....	
13,250	53,000	.013300	.000300	.....	.....	
13,500	54,000	.014175	.000875	.....	.....	
14,000	56,000	.015750	.001575	.....	.....	
14,500	58,000	.017550	.001800	.....	.....	
15,000	60,000	.019275	.001725	.....	.....	
15,500	62,000	.021675	.002400	.....	.....	
16,000	64,000	.023750	.002075	.....	.....	
16,500	66.000	.026000	.002250	.....	.....	
17,000	68,000	.028500	.002500	.....	.....	
17,500	70,000	.031250	.002750	.....	.....	
18,000	72,000	.0350	.003750	.....	.....	
18,500	74,000	.0400	.0050	.....	.....	
19,000	76,000	.0450	.0050	.....	.....	
19,500	78,000	.0500	.0050	.....	.....	
20,000	80,000	.0550	.0050	.....	.....	
21,030	84,120	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,120
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.0525
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.024
Reduction in area after rupture, per cent of original section		8.4
Position of rupture		2″ from the neck
Character of broken surface		granular, radiating from a spongy spot at the circumference
Elongation of inch sections		″.05, ″.05, ″.06, ″.05

No. 4501.

Marks, $\frac{10}{T}\ \frac{W\ R\ C_5}{O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
3,750	15,000	.000500	.000200	.....	.....	
5,000	20,000	.000675	.000175	.....	.....	
6,250	25,000	.000875	.000200	.000025	.000025	
7,500	30,000	.001075	.000200	.000050	.000025	
7,750	31,000	.001125	.000050	.....	.....	
8,000	32,000	.001175	.000050	.....	.....	
8,250	33,000	.001225	.000050	.....	.....	
8,500	34,000	.001300	.000075	.....	.....	Elastic limit.
8,750	35,000	.001450	.000150	.000275	.000225	
9,000	36,000	.001625	.000175	.....	.....	
9,250	37,000	.002525	.000900	.....	.....	
9,500	38,000	.004950	.002425	.....	.....	
9,750	39,000	.006250	.001300	.....	.....	
10,000	40,000	.009250	.003000	.....	.....	
10,250	41,000	.013750	.004500	.....	.....	
10,500	42,000	.015000	.001250	.....	.....	
10,750	43,000	.015875	.000875	.....	.....	
11,000	44,000	.017750	.001875	.....	.....	
11,250	45,000	.019375	.001625	.....	.....	
11,500	46,000	.021250	.001875	.....	.....	
11,750	47,000	.022750	.001500	.....	.....	
12,000	48,000	.024750	.002000	.....	.....	
12,250	49,000	.026625	.001875	.....	.....	
12,500	50,000	.029000	.002375	.....	.....	
13,000	52,000	.0325	.0035	.....	.....	
13,500	54,000	.0400	.0075	.....	.....	
14,000	56,000	.0475	.0075	.....	.....	
14,500	58,000	.0550	.0075	.....	.....	
15,000	60,000	.0625	.0075	.....	.....	
15,500	62,000	.0775	.0150	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	62,000
Elastic limit per square inch of original section	do	34,000
Elongation per inch after rupture	inch	.0775
Elongation per inch under strain at elastic limit	do	.001300
Reduction in diameter at point of rupture	do	.034
Reduction in area after rupture, per cent of original section		11.6
Position of rupture		″.15 from the neck
Character of broken surface		granular, spongy spot at the circumference 10 per cent
Elongation of inch sections		″.09*, ″.06, ″.07, ″.09

No. 4366.

Marks, $^{10\ W\ R_1\ C_5}_{T\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000200	.000200	.....	.....	
2,500	10,000	.000400	.000200	.....	.....	
3,750	15,000	.000550	.000150	.....	.....	
5,000	20,000	.000725	.000175	.....	.....	
6,250	25,000	.000925	.000200	.....	.....	
7,500	30,000	.001075	.000150	0.	.....	
8,750	35,000	.001250	.000175	.....	.....	
10,000	40,000	.001425	.000175	0.	.....	
11,250	45,000	.001575	.000150	.....	.....	
12,500	50,000	.001750	.000175	.000025	.000025	
12,750	51,000	.001775	.000025	.....	.....	
13,000	52,000	.001800	.000025	.....	.....	
13,250	53,000	.001850	.000050	.....	.....	
13,500	54,000	.001900	.000050	.....	.....	Elastic limit.
13,750	55,000	.002200	.000300	.....	.....	
14,000	56,000	.003000	.000800	.....	.....	
14,250	57,000	.003950	.000950	.....	.....	
14,500	58,000	.005450	.001500	.....	.....	
14,750	59,000	.008000	.002550	.....	.....	
15,000	60,000	.008775	.000775	.....	.....	
15,500	62,000	.010000	.001225	.....	.....	
16,000	64,000	.011000	.001000	.....	.....	
16,500	66,000	.012500	.001500	.....	.....	
17,000	68,000	.013925	.001425	.....	.....	
17,500	70,000	.015450	.001525	.....	.....	
18,000	72,000	.017000	.001550	.....	.....	
18,500	74,000	.018725	.001725	.....	.....	
19,000	76,000	.020500	.001775	.....	.....	
19,500	78,000	.021875	.001375	.....	.....	
20,000	80,000	.023950	.002075	.....	.....	
20,500	82,000	.026200	.002250	.....	.....	
21,000	84,000	.028000	.001800	.....	.....	
21,500	86,000	.0300	.0020	.....	.....	
22,000	88,000	.0312	.0012	.....	.....	
22,500	90,000	.0350	.0038	.....	.....	
23,000	92,000	.0400	.0050	.....	.....	
23,500	94,000	.0450	.0050	.....	.....	
24,000	96,000	.0475	.0025	.....	.....	
24,500	98,000	.0500	.0025	.....	.....	
25,000	100,000	.0550	.0050	.....	.....	
25,500	102,000	.0675	.0125	.....	.....	
26,000	104,000	.0750	.0075	.....	.....	
26,500	106,000	.0950	.0200	.....	.....	
26,520	106,080	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	106,080
Elastic limit per square inch of original section	do...	54,000
Elongation per inch after rupture	inch..	.1000
Elongation per inch under strain at elastic limit	do...	.001900
Reduction in diameter at point of rupture	do...	.044
Reduction in area after rupture, per cent of original section		15.0
Position of rupture		″.60 from the neck
Character of broken surface		granular; dull silky spot near the circumference
Elongation of inch sections		″.07, ″.09, ″.10, ″.14*

No. 4380.

Marks, $^{10\ W\ R_1\ C_5}_{T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000075	.000075	0.	.....	
2,500	10,000	.000275	.000200	.....	.....	
5,000	20,000	.000675	.000400	.....	.....	
7,500	30,000	.001025	.000350	0.	.....	
8,750	35,000	.001275	.000250	.....	.....	
9,000	36,000	.001325	.000050	.....	.....	Elastic limit.
9,250	37,000	.001450	.000125	.....	.....	
9,500	38,000	.001550	.000100	.....	.....	
9,750	39,000	.001800	.000250	.....	.....	
10,000	40,000	.002675	.000875	.001200	.001200	
10,250	41,000	.003300	.000625	.....	.....	
10,500	42,000	.004000	.000700	.....	.....	
10,750	43,000	.005250	.001250	.....	.....	
11,000	44,000	.011250	.006000	.....	.....	
11,250	45,000	.012500	.001250	.....	.....	
11,500	46,000	.013750	.001250	.....	.....	
11,750	47,000	.014925	.001175	.....	.....	
12,000	48,000	.016000	.001075	.....	.....	
12,250	49,000	.017000	.001000	.....	.....	
12,500	50,000	.018500	.001500	.....	.....	
13,000	52,000	.021500	.003000	.....	.....	
13,500	54,000	.024250	.002750	.....	.....	
14,000	56,000	.029000	.004750	.....	.....	
14,180	56,720	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section ..... pounds.. 56,720
Elastic limit per square inch of original section ..... do... 36,000
Elongation per inch after rupture ..... inch.. .0300
Elongation per inch under strain at elastic limit ..... do... .001325
Reduction in diameter at point of rupture ..... do... .044
Reduction in area after rupture, per cent of original section 15.0
Position of rupture ..... 1″.5 from the neck.
Character of broken surface ..... spongy; color varies from light steel color to black; opened cracks in stem.
Elongation of inch sections ..... ″.02, ″.05*, ″.02, ″.03

No. 4406.

Marks, $^{10\ W\ R_1\ C_5}_{T_3\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000275	.000175	.....	.....	
3,750	15,000	.000450	.000175	.....	.....	
5,000	20,000	.000600	.000150	.....	.....	
6,250	25,000	.000800	.000200	.....	.....	
7,500	30,000	.001050	.000250	.000025	.000025	
7,750	31,000	.001100	.000050	.....	.....	
8,000	32,000	.001150	.000050	.....	.....	
8,250	33,000	.001250	.000100	.....	.....	
8,500	34,000	.001300	.000050	.....	.....	
8,750	35,000	.001400	.000100	.....	.....	Elastic limit.
9,000	36,000	.003725	.002325	.....	.....	
9,250	37,000	.004950	.001225	.....	.....	
9,500	38,000	.006375	.001425	.....	.....	
9,750	39,000	.007400	.001025	.....	.....	
10,000	40,000	.008625	.001225	.....	.....	
10,250	41,000	.009700	.001075	.....	.....	
10,500	42,000	.011000	.001300	.....	.....	
10,750	43,000	.012000	.001000	.....	.....	
11,000	44,000	.013200	.001200	.....	.....	
11,250	45,000	.014250	.001050	.....	.....	
11,500	46,000	.015875	.001625	.....	.....	
11,750	47,000	.017000	.001125	.....	.....	
12,000	48,000	.018625	.001625	.....	.....	
12,250	49,000	.019875	.001250	.....	.....	
12,500	50,000	.021250	.001375	.....	.....	
13,000	52,000	.024750	.003500	.....	.....	
13,500	54,000	.028375	.003625	.....	.....	
14,000	56,000	.0325	.004125	.....	.....	
14,500	58,000	.0400	.0075	.....	.....	
15,000	60,000	.0450	.0050	.....	.....	
15,500	62,000	.0500	.0050	.....	.....	
16,000	64,000	.0575	.0075	.....	.....	
16,040	64,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	64.160
Elastic limit per square inch of original section	do...	35,000
Elongation per inch after rupture	inch..	.0600
Elongation per inch under strain at elastic limit	do...	.001400
Reduction in diameter at point of rupture	do...	.034
Reduction in area after rupture, per cent of original section		11.6
Position of rupture		″.25 from the neck
Character of broken surface		granular, small hole near the circumference
Elongation of inch sections		″.04, ″.04, ″.05, ″.11*

No. 4503.

Marks, $\frac{10\,W\,R\,C_5}{T_6\,M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
3,750	15,000	.000475	.000175	.....	.....	
5,000	20,000	.000650	.000175	.....	.....	
6,250	25,000	.000775	.000125	.....	.....	
7,500	30,000	.000950	.000175	0.	.....	
7,750	31,000	.000975	.000025	.....	.....	
8,000	32,000	.001025	.000050	.....	.....	
8,250	33,000	.001050	.000025	.....	.....	
8,500	34,000	.001075	.000025	.....	.....	
8,750	35,000	.001100	.000025	0.	.....	
9,000	36,000	.001150	.000050	.....	.....	
9,250	37,000	.001200	.000050	.....	.....	
9,500	38,000	.001225	.000025	.....	.....	
9,750	39,000	.001275	.000050	.....	.....	
10,000	40,000	.001300	.000025	0.	.....	
10,250	41,000	.001325	.000025	.....	.....	
10,500	42,000	.001350	.000025	.....	.....	
10,750	43,000	.001400	.000050	.....	.....	
11,000	44,000	.001450	.000050	.....	.....	
11,250	45,000	.001500	.000050	0.	.....	Elastic limit.
11,500	46,000	.018500	.017000	.....	.....	
11,750	47,000	.019625	.001125	.....	.....	
12,000	48,000	.021250	.001625	.....	.....	
12,250	49,000	.022925	.001675	.....	.....	
12,500	50,000	.025000	.002075	.....	.....	
13,000	52,000	.0300	.0050	.....	.....	
13,500	54,090	.0350	.0050	.....	.....	
14,000	56,000	.0425	.0075	.....	.....	
14,500	58,000	.0475	.0050	.....	.....	
15,000	60,000	.0525	.0050	.....	.....	
15,500	62,000	.0650	.0125	.....	.....	
16,000	64,000	.0750	.0100	.....	.....	
16,500	66,000	.0875	.0125	.....	.....	
17,000	68,000	.1050	.0175	.....	.....	
17,500	70,000	.1450	.0400	.....	.....	
17,840	71,360	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	71,360
Elastic limit per square inch of original section	do	45,000
Elongation per inch after rupture	inch	.2700
Elongation per inch under strain at elastic limit	do	.001500
Reduction in diameter at point of rupture	do	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″.7 from the neck
Character of broken surface		silky
Elongation of inch sections		″.21, ″.21, ″.22, ″.44*

TABULATION OF TENSION SPECIMENS FROM 10-INCH WIRE-WOUND RIFLE No. 1.

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.
			Pounds.	*Pounds.*	*Per ct.*	*Per ct.*	
4321	Jacket	Middle	39,000	89,480	14.7	36.4	Dull silky, 85 per cent; granular, 15 per cent.
4322	do	Outside	33,000	92,000	13.3	21.4	Granular; dull, silky spot.
4323	do	Middle	39,000	94,000	12.3	33.5	Granular, 60 per cent; silky, 40 per cent.
4324	do	Inside	40,000	94,960	10.0	18.3	Granular, 80 per cent; dull silky, 20 per cent.
4325	do	Middle	40,000	72,400	25.7	57.0	Silky.
4326	do	do	37,000	66,400	9.3	18.3	Granular; blow hole 1 inch diameter.
4327	do	Outside	39,000	67,920	7.3	8.4	Granular; blowhole ".08×".30.
4328	do	do	41,000	70,960	9.7	11.6	Granular; small blowholes.
4329	do	Middle	38,000	67,680	6.7	8.4	Granular; spongy spot.
4368	Trunnion hoop	Inside	47,000	88,680	10.3	21.4	Silky, oblique, light colored spots.
4370	do	Outside	49,000	90,960	12.5	27.6	Dull silky, oblique.
4369	do	Middle	50,000	86,000	11.8	24.6	Granular, 55 per cent; dull silky, 45 per cent.
4330	Hoop A_1	Inside	31,000	61,760	25.0	41.9	Silky.
4331	do	Outside	37,000	66,080	20.0	36.4	Dull silky.
4332	do	Middle	36,000	64,000	23.8	54.6	Silky.
4358	Hoop C_1	Inside	43,000	79,920	6.5	15.0	Granular, 50 per cent; dull silky and spongy, 50 per cent.
4356	do	Outside	43,000	78,320	6.8	11.6	Granular and dull flaky.
4357	do	Middle	43,000	72,880	5.5	15.0	Dull leaden and granular.
4333	Hoop C_2	Inside	†30,000	52,840	6.8	21.4	Silky and spongy.
4335*	do	do	31,000	61,640	9.7	18.3	Granular, 45 per cent; dull silky, with blowhole, 55 per cent.
4394	do	do	39,000	63,920	5.5	21.4	Silky, spongy.
4334	do	Middle	27,000	52,640	10.5	24.6	Do.
4336*	do	do	†20,000	36,460	6.0	27.6	Silky, 45 per cent; balance dark, unsound metal.
4395	do	do	45,000	78,840	21.3	33.5	Silky, oblique.
4393	do	Outside	45,000	80,000	15.5	27.6	Do.
4337*	Hoop C_3	Inside	38,000	69,640	2.7	4.8	Granular, 10 per cent; spongy spots.
4386	do	do	42,000	68,720	21.5	36.4	Silky, irregular.
4338*	do	Outside	47,000	65,280	2.0	4.8	Granular; 20 per cent spongy.
4387	do	do	41,000	69,440	24.5	49.7	Silky, irregular.
4339*	do	Middle	†30,000	58,440	2.7	4.8	Granular, 45 per cent; dark spongy, 55 per cent.
4388	do	do	37,000	64,000	14.5	24.6	Silky, oblique, spongy.
4367	Hoop C_5	Inside	52,000	105,880	15.8	36.4	Fine silky.
4379	do	do	43,000	81,680	14.0	18.3	Granular, flaky.
4405	do	do	31,000	62,160	9.0	15.0	Granular, 85 per cent; silky, spongy, 15 per cent.
4502	do	do	43,000	67,440	24.5	30.6	Granular, 60 per cent; silky, 40 per cent.
4365	do	Outside	52,000	91,720	3.5	4.8	Granular; small spongy spots.
4404	do	do	33,000	69,040	11.8	21.4	Granular.
4381	do	do	47,000	84,120	5.3	8.4	Granular; spongy spot.
4501	do	do	34,000	62,000	7.8	11.6	Granular; 10 per cent spongy.
4366	do	Middle	54,000	106,080	10.0	15.0	Granular; dull silky spot.
4380	do	do	36,000	56,720	3.0	15.0	Spongy.
4406	do	do	35,000	64,160	6.0	11.6	Granular.
4503	do	do	45,000	71,360	27.0	49.7	Silky.

† Below.

Jacket specimens 3 inches long, .564 inch diameter. Hoop specimens 4 inches long, .564 inch diameter, except those with *, which had 3 inch stems.

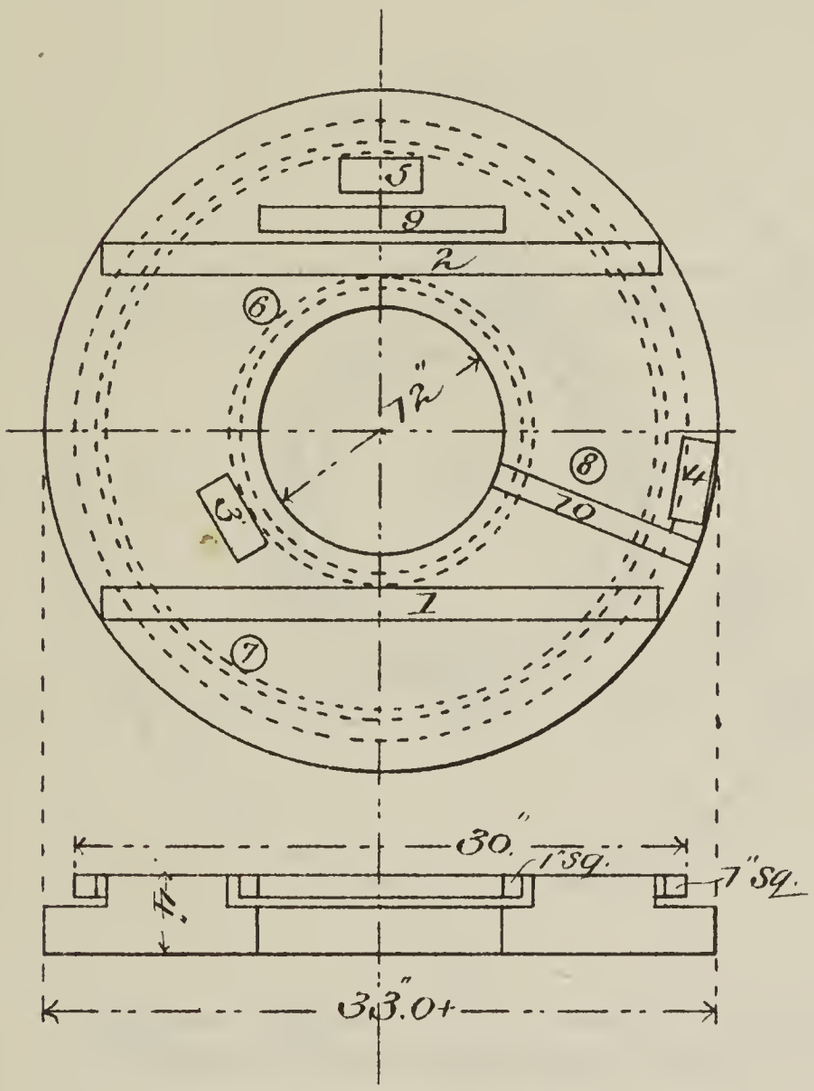
12-INCH B. L. RIFLED MORTARS.

SPECIMENS FROM CAST-IRON BODIES AND STEEL HOOPS.

12-inch B. L. Rifled Mortars

Cast iron Bodies

Breech end



H Ex 161 52 1

Cast-Iron Trial Cylinder.

No. 4411.

Marks, T C_{10}.
Diameter, 1″.128.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000085	.000035	.....	.....	
4,000	4,000	.000140	.000055	.....	.....	
5,000	5,000	.000185	.000045	0.	.....	
6,000	6,000	.000240	.000055	.....	.....	
7,000	7,000	.000290	.000050	.....	.....	
8,000	8,000	.000340	.000050	.....	.....	
9,000	9,000	.000395	.000055	.....	.....	
10,000	10,000	.000445	.000050	.000020	.000020	
11,000	11,000	.000505	.000060	.....	.....	
12,000	12,000	.000560	.000055	.....	.....	
13,000	13,000	.000610	.000050	.....	.....	
14,000	14,000	.000680	.000070	.....	.....	
15,000	15,000	.000745	.000065	.000060	.000040	
16,000	16,000	.000810	.000065	.....	.....	
17,000	17,000	.000875	.000065	.....	.....	
18,000	18,000	.000950	.000075	.....	.....	
19,000	19,000	.001025	.000075	.....	.....	
20,000	20,000	.001105	.000080	.000155	.000095	
21,000	21,000	.001200	.000095	.....	.....	
22,000	22,000	.001305	.000105	.000240	.000085	
23,000	23,000	.001410	.000105	.....	.....	
24,000	24,000	.001530	.000120	.000335	.000095	
25,000	25,000	.001685	.000155	.....	.....	
26,000	26,000	.001835	.000150	.000505	.000170	
27,000	27,000	.002010	.000175	.....	.....	
28,000	28,000	.002275	.000265	.000815	.000310	
29,000	29,000	.002560	.000285	.....	.....	
30,000	30,000	.002950	.000390	.001340	.000525	
34,520	34,520	.....	.....	.....	.....	Tensile strength.

Fractured 6½ inches from the neck.
Appearance uniform granular.

No. 4412.

Marks, T C_{11}.
Diameter, 1″.135.
Sectional area, 1.01 square inch.
Length of stem, 19″.5.
Gauged length, $16\frac{2}{3}$″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,010	1,000	0.	0.	0.	0.	Initial load.
2,020	2,000	.000042	.000042	.....	.....	
3,030	3,000	.000078	.000036	.....	.....	
4,040	4,000	.000132	.000054	.....	.....	
5,050	5,000	.000186	.000054	0.	.....	
6,060	6,000	.000234	.000048	.....	.....	
7,070	7,000	.000288	.000054	.....	.....	
8,080	8,000	.000336	.000048	.....	.....	
9,090	9,000	.000378	.000042	.....	.....	
10,100	10,000	.000432	.000054	.000006	.000006	
11,110	11,000	.000486	.000054	.....	.....	
12,120	12,000	.000546	.000060	.....	.....	
13,130	13,000	.000606	.000060	.....	.....	
14,140	14,000	.000666	.000060	.....	.....	
15,150	15,000	.000726	.000060	.000054	.000048	
16,160	16,000	.000786	.000060	.....	.....	
17,170	17,000	.000846	.000060	.....	.....	
18,180	18,000	.000912	.000066	.....	.....	
19,190	19,000	.001002	.000090	.....	.....	
20,200	20,000	.001080	.000078	.000132	.000078	
21,210	21,000	.001188	.000108	.....	.....	
22,220	22,000	.001272	.000084	.000216	.000084	
23,230	23,000	.001386	.000114	.....	.....	
24,240	24,000	.001500	.000114	.000312	.000096	
25,250	25,000	.001662	.000162	.....	.....	
26,260	26,000	.001860	.000198	.000528	.000216	
27,270	27,000	.002034	.000174	.....	.....	
28,280	28,000	.002232	.000198	.000792	.000264	
29,290	29,000	.002622	.000390	.....	.....	
30,300	30,000	.002880	.000258	.001302	.000510	
35,080	34,730	.....	.....	.....	.....	Tensile strength.

Fractured 6 inches from the neck.
Appearance uniform granular.

No. 930.

Marks, T C_{14}.
Length, 10″.5.
Diameter, 1″.120.
Sectional area, .985 square inch.
Gauged length, 6″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
985	1,000	0.	.0	0.	0.	Initial load.
1,970	2,000	.000017	.000017	.....	.....	
2,955	3,000	.000033	.000016	.....	.....	
3,940	4,000	.000050	.000017	.....	.....	
4,925	5,000	.000083	.000033	.000017	.000017	
5,910	6,000	.000133	.000050	.....	.....	
6,895	7,000	.000167	.000034	.....	.....	
7,880	8,000	.000200	.000033	.....	.....	
8,865	9,000	.000233	.000033	.000033	.000016	
9,850	10,000	.000317	.000084	.....	.....	
10,835	11,000	.000367	.000050	.....	.....	
11,820	12,000	.000400	.000033	.....	.....	
12,805	13,000	.000433	.000033	.....	.....	
13,790	14,000	.000467	.000034	.....	.....	
14,775	15,000	.000500	.000033	.000067	.000034	
15,760	16,000	.000567	.000067	.....	.....	
16,745	17,000	.000633	.000066	.....	.....	
17,730	18,000	.000667	.000034	.....	.....	
18,715	19,000	.000717	.000050	.....	.....	
19,700	20,000	.000767	.000050	.000083	.000016	
20,685	21,000	.000833	.000066	.....	.....	
21,670	22,000	.000900	.000067	.....	.....	
22,655	23,000	.000933	.000033	.....	.....	
23,640	24,000	.000983	.000050	.....	.....	
24,625	25,000	.001050	.000067	.000133	.000050	
25,610	26,000	.001117	.000067	.....	.....	
26,595	27,000	.001200	.000083	.....	.....	
27,580	28,000	.001250	.000050	.....	.....	
28,565	29,000	.001333	.000083	.....	.....	
29,550	30,000	.001417	.000084	.000250	.000117	
30,535	31,000	.001550	.000133	.....	.....	
31,520	32,000	.001633	.000083	.....	.....	
32,505	33,000	.001783	.000150	.....	.....	
33,490	34,000	.001950	.000167	.....	.....	
34,475	35,000	.002133	.000183	.000717	.000467	
35,460	36,000	.002417	.000284	.....	.....	
36,445	37,000	.002667	.000250	.....	.....	
37,430	38,000	.003000	.000333	.....	.....	
38,415	39,000	.003283	.000283	.....	.....	
39,400	40,000	.003717	.000434	.002083	.001366	
40,385	41,000	.004250	.000533	.....	.....	
41,370	42,000	.004617	.000367	.....	.....	
42,355	43,000	.005117	.000500	.....	.....	
43,340	44,000	.005500	.000333	.....	.....	
44,325	45,000	.005833	.000333	.004017	.001934	
58,320	59,210	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 931.

Marks, T C_{15}.
Length, 10″.5.
Diameter, 1″.118.
Sectional area, .983 square inch.
Gauged length, 6″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
983	1,000	0.	0.	0.	0.	Initial load.
1,966	2,000	.000017	.000017	.....	.....	
2,949	3,000	.000033	.000016	.....	.....	
3,932	4,000	.000050	.000017	.....	.....	
4,915	5,000	.000083	.000033	.000017	.000017	
5,898	6,000	.000133	.000050	.....	.....	
6,881	7,000	.000183	.000050	.....	.....	
7,864	8,000	.000233	.000050	.....	.....	
8,847	9,000	.000283	.000050	.....	.....	
9,830	10,000	.000317	.000034	.000033	.000016	
10,813	11,000	.000383	.000066	.....	.....	
11,796	12,000	.000433	.000050	.....	.....	
12,779	13,000	.000483	.000050	.....	.....	
13,762	14,000	.000517	.000034	.....	.....	
14,745	15,000	.000567	.000050	.000033	0.	
15,728	16,000	.000617	.000050	.....	.....	
16,711	17,000	.000667	.000050	.....	.....	
17,694	18,000	.000700	.000033	.....	.....	
18,677	19,000	.000750	.000050	.....	.....	
19,660	20,000	.000800	.000050	.000067	.000034	
20,643	21,000	.000867	.000067	.....	.....	
21,626	22,000	.000750	.000083	.....	.....	
22,609	23,000	.000983	.000233	.....	.....	
23,592	24,000	.001033	.000050	.....	.....	
24,575	25,000	.001100	.000067	.000150	.000083	
25,558	26,000	.001183	.000083	.....	.....	
26,541	27,000	.001267	.000084	.....	.....	
27,524	28,000	.001317	.000050	.....	.....	
28,507	29,000	.001383	.000066	.....	.....	
29,490	30,000	.001500	.000117	.000250	.000100	
30,473	31,000	.001583	.000083	.....	.....	
31,456	32,000	.001700	.000117	.....	.....	
32,439	33,000	.001833	.000133	.....	.....	
33,422	34,000	.001983	.000150	.....	.....	
34,405	35,000	.002200	.000217	.000733	.000483	
35,388	36,000	.002417	.000217	.....	.....	
36,371	37,000	.002750	.000333	.....	.....	
37,354	38,000	.003083	.000333	.....	.....	
38,337	39,000	.003483	.000400	.....	.....	
39,320	40,000	.003917	.000434	.002250	.001417	
40,303	41,000	.004333	.000416	.....	.....	
41,286	42,000	.004817	.000484	.....	.....	
42,269	43,000	.005417	.000600	.....	.....	
43,252	44,000	.005800	.000383	.....	.....	
44,235	45,000	.006350	.000550	.004483	.002233	
58,130	59,140	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 932.

Marks, T C_{16}
Length, 10″.5.
Diameter, 1″.136.
Sectional area, 1.01 square inch.
Gauged length, 6″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,010	1,000	0.	0.	0.	0.	Initial load.
2,020	2,000	.000017	.000017	.....	.....	
3,030	3,000	.000033	.000016	.....	.....	
4,040	4,000	.000067	.000034	.....	.....	
5,050	5,000	.000100	.000033	0.	.....	
6,060	6,000	.000150	.000050	.....	.....	
7,070	7,000	.000200	.000050	.....	.....	
8,080	8,000	.000250	.000050	.....	.....	
9,090	9,000	.000317	.000067	.....	.....	
10,100	10,000	.000350	.000033	.000017	.000017	
11,110	11,000	.000400	.000050	.....	.....	
12,120	12,000	.000433	.000033	.....	.....	
13,130	13,000	.000483	.000050	.....	.....	
14,140	14,000	.000533	.000050	.....	.....	
15,150	15,000	.000567	.000034	.000050	.000033	
16,160	16,000	.000650	.000083	.....	.....	
17,170	17,000	.000700	.000050	.....	.....	
18,180	18,000	.000733	.000033	.....	.....	
19,190	19,000	.000783	.000050	.....	.....	
20,200	20,000	.000850	.000067	.000067	.000017	
21,210	21,000	.000917	.000067	.....	.....	
22,220	22,000	.000967	.000050	.....	.....	
23,230	23,000	.001033	.000066	.....	.....	
24,240	24,000	.001083	.000050	.....	.....	
25,250	25,000	.001167	.000084	.000117	.000050	
26,260	26,000	.001233	.000066	.....	.....	
27,270	27,000	.001300	.000067	.....	.....	
28,280	28,000	.001350	.000050	.....	.....	
29,290	29,000	.001417	.000067	.....	.....	
30,300	30,000	.001500	.000033	.000250	.000133	
31,310	31,000	.001600	.000100	.....	.....	
32,320	32,000	.001717	.000117	.....	.....	
33,330	33,000	.001833	.000116	.....	.....	
34,340	34,000	.001983	.000150	.....	.....	
35,350	35,000	.002167	.000184	.000817	.000567	
36,360	36,000	.002483	.000316	.....	.....	
37,370	37,000	.002633	.000150	.....	.....	
38,380	38,000	.002883	.000250	.....	.....	
39,390	39,000	.003250	.000367	.....	.....	
40,400	40,000	.003733	.000483	.002000	.001133	
41,410	41,000	.004083	.000350	.....	.....	
42,420	42,000	.004550	.000467	.....	.....	
43,430	43,000	.005083	.000533	.....	.....	
44,440	44,000	.005550	.000467	.....	.....	
45,450	45,000	.006133	.000583	.004167	.002167	
60,900	60,300	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

Cast-Iron Body No. 1.

No. 4549.

Marks, $\overset{12\,M\,R_1\,T\,R_2}{B\,T_1}$.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000035	.000035	.....	.....	
3,000	3,000	.000085	.000050	.....	.....	
4,000	4,000	.000135	.000050	.....	.....	
5,000	5,000	.000185	.000050	.000005	.000005	
6,000	6,000	.000235	.000050	.....	.....	
7,000	7,000	.000290	.000055	.....	.....	
8,000	8,000	.000345	.000055	.....	.....	
9,000	9,000	.000400	.000055	.....	.....	
10,000	10,000	.000455	.000055	.000025	,000020	
11,000	11,000	.000510	.000055	.....	.....	
12,000	12,000	.000565	.000055	.....	.....	
13,000	13,000	.000635	.000070	.....	.....	
14,000	14,000	.000700	.000065	.....	.....	
15,000	15,000	.000755	.000055	.000060	.000035	
16,000	16,000	.000835	.000080	.....	.....	
17,000	17,000	.000905	.000070	.....	.....	
18,000	18,000	.000970	.000065	.....	.....	
19,000	19,000	.001050	.000080	.....	.....	
20,000	20,000	.001140	.000090	.000155	.000095	
21,000	21,000	.001240	.000100	.....	.....	
22,000	22,000	.001340	.000100	.....	.....	
23,000	23,000	.001455	.000115	.....	.....	
24,000	24,000	.001590	.000135	.....	.....	
25,000	25,000	.001735	.000145	.000385	.000230	
26,000	26,000	.001900	.000165	.....	.....	
27,000	27,000	.002065	.000165	.....	.....	
28,000	28,000	.002330	.000265	.000750	.000365	
30,040	30,040	.....	.....	.....	.....	Tensile strength.

Fractured ½ inch from the neck.
Appearance uniform granular,

No. 944.

Marks, $\frac{12\ M\ R_1\ T\ R_2}{B\ T_2}$
Length, 10″.5.
Diameter, 1″.123.
Sectional area, .99 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
990	1,000	0.	0.	0.	0.	Initial load.
1,980	2,000	.00006	.00006	.....	.....	
2,970	3,000	.00012	.00006	.....	.....	
3,960	4,000	.00020	.00008	.....	.....	
4,950	5,000	.00026	.00006	0.	.....	
5,940	6,000	.00032	.00006	.....	.....	
6,930	7,000	.00036	.00004	.....	.....	
7,920	8,000	.00042	.00006	.....	.....	
8,910	9,000	.00050	.00008	.....	.....	
9,900	10,000	.00054	.00004	0.	.....	
10,890	11,000	.00060	.00006	.....	.....	
11,880	12,000	.00064	.00004	.....	.....	
12,870	13,000	.00072	.00008	.....	.....	
13,860	14,000	.00078	.00006	.....	.....	
14,850	15,000	.00084	.00006	.00008	.00008	
15,840	16,000	.00092	.00008	.....	.....	
16,830	17,000	.00098	.00006	.....	.....	
17,820	18,000	.00104	.00006	.....	.....	
18,810	19,000	.00110	.00006	.....	.....	
19,800	20,000	.00116	.00006	.00012	.00004	
20,790	21,000	.00124	.00008	.....	.....	
21,780	22,000	.00130	.00006	.....	.....	
22,770	23,000	.00138	.00008	.....	.....	
23,760	24,000	.00148	.00010	.....	.....	
24,750	25,000	.00160	.00012	.00022	.00010	
25,740	26,000	.00166	.00006	.....	.....	
26,730	27,000	.00180	.00014	.....	.....	
27,720	28,000	.00190	.00010	.....	.....	
28,710	29,000	.00200	.00010	.....	.....	
29,700	30,000	.00214	.00014	.00060	.00038	
30,690	31,000	.00234	.00020	.....	.....	
31,680	32,000	.00252	.00018	.....	.....	
32,670	33,000	.00266	.00014	.....	.....	
33,660	34,000	.00286	.00020	.....	.....	
34,650	35,000	.00318	.00032	.00134	.00074	
35,640	36,000	.00354	.00036	.....	.....	
36,630	37,000	.00386	.00032	.....	.....	
37,620	38,000	.00416	.00030	.....	.....	
38,610	39,000	.00456	.00040	.....	.....	
39,600	40,000	.00516	.00060	.00300	.00166	
40,590	41,000	.00560	.00044	.....	.....	
41,580	42,000	.00600	.00040	.....	.....	
42,570	43,000	.00644	.00044	.....	.....	
43,560	44,000	.00678	.00034	.....	.....	
44,550	45,000	.00750	.00072	.00506	.00206	
57,200	57,780	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 945.

Marks, $\frac{12\ M\ R_1\ T\ R_2}{B\ R_{10}}$
Length, 10″.5.
Diameter, 1″.123.
Sectional area, .99 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
990	1,000	0.	0.	0.	0.	Initial load.
1,980	2,000	.00004	.00004	.....	.....	
2,970	3,000	.00012	.00008	.....	.....	
3,960	4,000	.00018	.00006	.....	.....	
4,950	5,000	.00022	.00004	0.	.....	
5,940	6,000	.00026	.00004	.....	.....	
6,930	7,000	.00032	.00006	.....	.....	
7,920	8,000	.00040	.00008	.....	.....	
8,910	9,000	.00044	.00004	.....	.....	
9,900	10,000	.00050	.00006	0.	.....	
10,890	11,000	.00056	.00006	.....	.....	
11,880	12,000	.00062	.00006	.....	.....	
12,870	13,000	.00066	.00004	.....	.....	
13,860	14,000	.00072	.00006	.....	.....	
14,850	15,000	.00080	.00008	.00004	.00004	
15,840	16,000	.00084	.00004	.....	.....	
16,830	17,000	.00090	.00006	.....	.....	
17,820	18,000	.00096	.00006	.....	.....	
18,810	19,000	.00102	.00006	.....	.....	
19,800	20,000	.00110	.00008	.00010	.00006	
20,790	21,000	.00118	.00008	.....	.....	
21,780	22,000	.00124	.00006	.....	.....	
22,770	23,000	.00134	.00010	.....	.....	
23,760	24,000	.00140	.00006	.....	.....	
24,750	25,000	.00150	.00010	.00022	.00012	
25,740	26,000	.00160	.00010	.....	.....	
26,730	27,000	.00170	.00010	.....	.....	
27,720	28,000	.00180	.00010	.....	.....	
28,710	29,000	.00190	.00010	.....	.....	
29,700	30,000	.00206	.00016	.00056	.00034	
30,690	31,000	.00230	.00024	.....	.....	
31,680	32,000	.00246	.00016	.....	.....	
32,670	33,000	.00270	.00024	.....	.....	
33,660	34,000	.00298	.00028	.....	.....	
34,650	35,000	.00330	.00032	.00150	.00094	
35,640	36,000	.00366	.00036	.....	.....	
36,630	37,000	.00404	.00038	.....	.....	
37,620	38,000	.00444	.00040	.....	.....	
38,610	39,000	.00488	.00044	.....	.....	
39,600	40,000	.00540	.00052	.00330	.00180	
40,590	41,000	.00584	.00044	.....	.....	
41,580	42,000	.00624	.00040	.....	.....	
42,570	43,000	.00680	.00056	.....	.....	
43,560	44,000	.00734	.00054	.....	.....	
44,550	45,000	.00804	.00070	.00586	.00256	
58,760	59,350	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4550.

Marks, $\frac{12\,M\,R_1\,T\,R_1}{M\,T_1}$
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000035	.000035	.....	.....	
3,000	3,000	.000085	.000050	.....	.....	
4,000	4,000	.000135	.000050	.....	.....	
5,000	5,000	.000190	.000055	.000005	.000005	
6,000	6,000	.000250	.000060	.....	.....	
7,000	7,000	.000310	.000060	.....	.....	
8,000	8,000	.000370	.000060	.....	.....	
9,000	9,000	.000440	.000070	.....	.....	
10,000	10,000	.000505	.000065	.000005	.000010	
11,000	11,000	.000580	.000075	.....	.....	
12,000	12,000	.000650	.000070	.....	.....	
13,000	13,000	.000735	.000085	.....	.....	
14,000	14,000	.000810	.000075	.....	.....	
15,000	15,000	.000900	.000090	.000065	.000060	
16,000	16,000	.000990	.000090	.....	.....	
17,000	17,000	.001100	.000110	.....	.....	
18,000	18,000	.001205	.000105	.....	.....	
19,000	19,000	.001350	.000145	.....	.....	
20,000	20,000	.001490	.000140	.000285	.000220	
21,000	21,000	.001650	.000160	.....	.....	
22,000	22,000	.001860	.000210	.....	.....	
23,000	23,000	.002100	.000240	.....	.....	
24,000	24,000	.002400	.000300	.....	.....	
25,000	25,000	.002770	.000370	.001100	.000815	
28,360	28,360	.....	.....	.....	.....	Tensile strength.

Fractured $10\frac{3}{4}$″ from the neck.
Appearance uniform granular.

No. 946.

Marks, $^{12}_{M}\ M\ R_1\ T\ R_1\ T_2$
Length, 10″.5.
Diameter, 1″.127.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00008	.00008	.....	.....	
3,000	3,000	.00012	.00004	.....	.....	
4,000	4,000	.00018	.00006	.....	.....	
5,000	5,000	.00024	.00006	0.	.....	
6,000	6,000	.00030	.00006	.....	.....	
7,000	7,000	.00034	.00004	.....	.....	
8,000	8,000	.00040	.00006	.....	.....	
9,000	9,000	.00044	.00004	.....	.....	
10,000	10,000	.00050	.00006	.00002	.00002	
11,000	11,000	.00056	.00006	.....	.....	
12,000	12,000	.00060	.00004	.....	.....	
13,000	13,000	.00066	.00006	.....	.....	
14,000	14,000	.00070	.00004	.....	.....	
15,000	15,000	.00076	.00006	.00004	.00002	
16,000	16,000	.00082	.00006	.....	.....	
17,000	17,000	.00086	.00004	.....	.....	
18,000	18,000	.00092	.00006	.....	.....	
19,000	19,000	.00098	.00006	.....	.....	
20,000	20,000	.00104	.00006	.00006	.00002	
21,000	21,000	.00110	.00006	.....	.....	
22,000	22,000	.00116	.00006	.....	.....	
23,000	23,000	.00122	.00006	.....	.....	
24,000	24,000	.00128	.00006	.....	.....	
25,000	25,000	.00134	.00006	.00014	.00008	
26,000	26,000	.00140	.00006	.....	.....	
27,000	27,000	.00146	.00006	.....	.....	
28,000	28,000	.00154	.00008	.....	.....	
29,000	29,000	.00162	.00008	.....	.....	
30,000	30,000	.00168	.00006	.00020	.00006	
31,000	31,000	.00176	.00008	.....	.....	
32,000	32,000	.00182	.00006	.....	.....	
33,000	33,000	.00190	.00008	.....	.....	
34,000	34,000	.00200	.00010	.....	.....	
35,000	35,000	.00214	.00014	.00040	.00020	
36,000	36,000	.00224	.00010	.....	.....	
37,000	37,000	.00232	.00008	.....	.....	
38,000	38,000	.00248	.00016	.....	.....	
39,000	39,000	.00262	.00014	.....	.....	
40,000	40,000	.00280	.00018	.00082	.00042	
41,000	41,000	.00300	.00020	.....	.....	
42,000	42,000	.00316	.00016	.....	.....	
43,000	43,000	.00340	.00024	.....	.....	
44,000	44,000	.00366	.00026	.....	.....	
45,000	45,000	.00396	.00030	.00172	.00090	
46,000	46,000	.00432	.00036	.....	.....	
47,000	47,000	.00466	.00034	.....	.....	
48,000	48,000	.00500	.00034	.....	.....	
49,000	49,000	.00524	.00024	.....	.....	
50,000	50,000	.00594	.00070	.00340	.00168	
66,180	66,180	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

Cast-Iron Body No. 2.

No. 4555.

Marks, $^{12}\,\mathrm{M}\,\mathrm{R}_2\,\mathrm{T}\,\mathrm{R}_2$ / $\mathrm{B}\,\mathrm{T}_1$
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 20″.
Length of stem, 23″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000060	.000060	.....	.....	
3,000	3,000	.000115	.000055	.....	.....	
4,000	4,000	.000185	.000070	.....	.....	
5,000	5,000	.000240	.000055	.000005	.000005	
6,000	6,000	.000295	.000055	.....	.....	
7,000	7,000	.000360	.000065	.....	.....	
8,000	8,000	.000430	.000070	.....	.....	
9,000	9,000	.000495	.000065	.....	.....	
10,000	10,000	.000560	.000065	.000045	.000040	
11,000	11,000	.000645	.000085	.....	.....	
12,000	12,000	.000725	.000080	.000065	.000020	
13,000	13,000	.000810	.000085	.....	.....	
14,000	14,000	.000910	.000100	.000105	.000040	
15,000	15,000	.001005	.000095	.....	.....	
16,000	16,000	.001105	.000100	.000160	.000055	
17,000	17,000	.001225	.000120	.....	.....	
18,000	18,000	.001350	.000125	.000205	.000045	
19,000	19,000	.001510	.000160	.....	.....	
20,000	20,000	.001660	.000150	.000405	.000200	
21,000	21,000	.001875	.000215	.....	.....	
22,000	22,000	.002105	.000230	.000685	.000280	
23,000	23,000	.002400	.000295	.....	.....	
24,000	24,000	.002735	.000335	.001110	.000425	
25,000	25,000	.003125	.000380	.001405	.000295	
26,070	26,070	.....	.....	.....	.....	Tensile strength.

Fractured 4.″5 from neck.
Appearance uniform granular.

No. 949.

Marks, $\frac{12\ M\ R_2\ T\ R_2}{B\ T_2}$.
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00018	.00006	.....	.....	
5,000	5,000	.00024	.00006	0.	.....	
6,000	6,000	.00030	.00006	.....	.....	
7,000	7,000	.00036	.00006	.....	.....	
8,000	8,000	.00042	.00006	.....	.....	
9,000	9,000	.00048	.00006	.....	.....	
10,000	10,000	.00054	.00006	0.	.....	
11,000	11,000	.00062	.00008	.....	.....	
12,000	12,000	.00068	.00006	.....	.....	
13,000	13,000	.00074	.00006	.....	.....	
14,000	14,000	.00080	.00006	.....	.....	
15,000	15,000	.00086	.00006	.00006	.00006	
16,000	16,000	.00094	.00008	.....	.....	
17,000	17,000	.00100	.00006	.....	.....	
18,000	18,000	.00106	.00006	.....	.....	
19,000	19,000	.00112	.00006	.....	.....	
20,000	20,000	.00120	.00008	.00012	.00006	
21,000	21,000	.00130	.00010	.....	.....	
22,000	22,000	.00138	.00008	.....	.....	
23,000	23,000	.00144	.00006	.....	.....	
24,000	24,000	.00154	.00010	.....	.....	
25,000	25,000	.00164	.00010	.00028	.00016	
26,000	26,000	.00176	.00012	.....	.....	
27,000	27,000	.00186	.00010	.....	.....	
28,000	28,000	.00200	.00014	.....	.....	
29,000	29,000	.00216	.00016	.....	.....	
30,000	30,000	.00230	.00014	.00064	.00036	
31,000	31,000	.00252	.00022	.....	.....	
32,000	32,000	.00266	.00014	.....	.....	
33,000	33,000	.00290	.00024	.....	.....	
34,000	34,000	.00320	.00030	.....	.....	
35,000	35,000	.00356	.00036	.00164	.00100	
36,000	36,000	.00386	.00030	.....	.....	
37,000	37,000	.00434	.00048	.....	.....	
38,000	38,000	.00464	.00030	.....	.....	
39,000	39,000	.00506	.00042	.....	.....	
40,000	40,000	.00554	.00048	.00334	.00170	
41,000	41,000	.00600	.00046	.....	.....	
42,000	42,000	.00644	.00044	.....	.....	
43,000	43,000	.00676	.00032	.....	.....	
44,000	44,000	.00720	.00044	.....	.....	
45,000	45,000	.00760	.00040	.00514	.00184	
57,080	57,080	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 950.

Marks, $\frac{12\ M\ R_2\ T\ R_2}{B\ R_{10}}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00014	.00008	.....	.....	
4,000	4,000	.00020	.00006	.....	.....	
5,000	5,000	.00026	.00006	0.	.....	
6,000	6,000	.00034	.00008	.....	.....	
7,000	7,000	.00040	.00006	.....	.....	
8,000	8,000	.00046	.00006	.....	.....	
9,000	9,000	.00052	.00006	.....	.....	
10,000	10,000	.00058	.00006	.00004	.00004	
11,000	11,000	.00062	.00004	.....	.....	
12,000	12,000	.00070	.00008	.....	.....	
13,000	13,000	.00076	.00006	.....	.....	
14,000	14,000	.00082	.00006	.....	.....	
15,000	15,000	.00092	.00010	.00008	.00004	
16,000	16,000	.00096	.00004	.....	.....	
17,000	17,000	.00102	.00006	.....	.....	
18,000	18,000	.00108	.00006	.....	.....	
19,000	19,000	.00114	.00006	.....	.....	
20,000	20,000	.00122	.00008	.00016	.00008	
21,000	21,000	.00130	.00008	.....	.....	
22,000	22,000	.00138	.00008	.....	.....	
23,000	23,000	.00146	.00008	.....	.....	
24,000	24,000	.00158	.00012	.....	.....	
25,000	25,000	.00168	.00010	.00034	.00018	
26,000	26,000	.00180	.00012	.....	.....	
27,000	27,000	.00190	.00010	.....	.....	
28,000	28,000	.00204	.00014	.....	.....	
29,000	29,000	.00220	.00016	.....	.....	
30,000	30,000	.00242	.00022	.00078	.00044	
31,000	31,000	.00266	.00024	.....	.....	
32,000	32,000	.00282	.00016	.....	.....	
33,000	33,000	.00310	.00028	.....	.....	
34,000	34,000	.00346	.00036	.....	.....	
35,000	35,000	.00386	.00040	.00196	.00118	
36,000	36,000	.00436	.00050	.....	.....	
37,000	37,000	.00468	.00032	.....	.....	
38,000	38,000	.00504	.00036	.....	.....	
39,000	39,000	.00566	.00062	.....	.....	
40,000	40,000	.00622	.00056	.00400	.00204	
41,000	41,000	.00660	.00038	.....	.....	
42,000	42,000	.00716	.00056	.....	.....	
43,000	43,000	.00776	.00060	.....	.....	
44,000	44,000	.00838	.00062	.....	.....	
45,000	45,000	.00892	.00054	.00640	.00240	
8,6 10	58,610	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4556.

Marks, $\frac{12\ M\ R_2\ T\ R_1}{M\ T_1}$.
Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000300	.000050	.....	.....	
8,000	8,000	.000350	.000050	.....	.....	
9,000	9,000	.000400	.000050	.....	.....	
10,000	10,000	.000455	.000055	.000015	.000015	
11,000	11,000	.000505	.000050	.....	.....	
12,000	12,000	.000560	.000055	.000025	.000010	
13,000	13,000	.000630	.000070	.....	.....	
14,000	14,000	.000705	.000075	.000045	.000020	
15,000	15,000	.000765	.000060	.....	.....	
16,000	16,000	.000840	.000075	.000070	.000025	
17,000	17,000	.000910	.000070	.....	.....	
18,000	18,000	.000990	.000080	.000100	.000030	
19,000	19,000	.001070	.000080	.....	.....	
20,000	20,000	.001160	.000090	.000160	.000060	
21,000	21,000	.001260	.000100	.....	.....	
22,000	22,000	.001370	.000110	.000240	.000080	
23,000	23,000	.001495	.000125	.....	.....	
24,000	24,000	.001620	.000125	.000350	.000110	
25,000	25,000	.001785	.000165	.000440	.000090	
31,050	31,050	.....	.....	.....	.....	Tensile strength.

Fractured 2″ from neck.
Appearance uniform granular.

No. 951.

Marks, $\frac{12\,M\ R_2\ T\ R_1}{M\ T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00018	.00006	.....	.....	
5,000	5,000	.00024	.00006	0.	.....	
6,000	6,000	.00030	.00006	.....	.....	
7,000	7,000	.00036	.00006	.....	.....	
8,000	8,000	.00042	.00006	.....	.....	
9,000	9,000	.00048	.00006	.....	.....	
10,000	10,000	.00054	.00006	.00002	.00002	
11,000	11,000	.00060	.00006	.....	.....	
12,000	12,000	.00064	.00004	.....	.....	
13,000	13,000	.00070	.00006	.....	.....	
14,000	14,000	.00076	.00006	.....	.....	
15,000	15,000	.00082	.00006	.00006	.00004	
16,000	16,000	.00088	.00006	.....	.....	
17,000	17,000	.00094	.00006	.....	.....	
18,000	18,000	.00100	.00006	.....	.....	
19,000	19,000	.00106	.00006	.....	.....	
20,000	20,000	.00112	.00006	.00010	.00004	
21,000	21,000	.00120	.00008	.....	.....	
22,000	22,000	.00126	.00006	.....	.....	
23,000	23,000	.00132	.00006	.....	.....	
24,000	24,000	.00140	.00008	.....	.....	
25,000	25,000	.00146	.00006	.00018	.00008	
26,000	26,000	.00154	.00008	.....	.....	
27,000	27,000	.00160	.00006	.....	.....	
28,000	28,000	.00170	.00010	.....	.....	
29,000	29,000	.00180	.00010	.....	.....	
30,000	30,000	.00188	.00008	.00030	.00012	
31,000	31,000	.00196	.00008	.....	.....	
32,000	32,000	.00208	.00012	.....	.....	
33,000	33,000	.00218	.00010	.....	.....	
34,000	34,000	.00230	.00012	.....	.....	
35,000	35,000	.00244	.00014	.00060	.00030	
36,000	36,000	.00260	.00016	.....	.....	
37,000	37,000	.00280	.00020	.....	.....	
38,000	38,000	.00294	.00014	.....	.....	
39,000	39,000	.00314	.00020	.....	.....	
40,000	40,000	.00352	.00038	.00136	.00076	
41,000	41,000	.00376	.00024	.....	.....	
42,000	42,000	.00396	.00020	.....	.....	
43,000	43,000	.00434	.00038	.....	.....	
44,000	44,000	.00470	.00036	.....	.....	
45,000	45,000	.00520	.00050	.00278	.00142	
46,000	46,000	.00566	.00046	.....	.....	
47,000	47,000	.00604	.00038	.....	.....	
48,000	48,000	.00640	.00036	.....	.....	
49,000	49,000	.00694	.00054	.....	.....	
50,000	50,000	.00742	.00048	.00470	.00192	
62,350	62,350	.....	.....	.....	.....	**Ultimate strength.**

Failed by triple flexure.

Cast-Iron Body No. 3.

No. 4559.

Marks, $\overset{12\ M\ R_3\ T\ R_2}{B\ T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 20.″
Length of stem 23.″

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000060	.000060	.....	.....	
3,000	3,000	.000125	.000065	.....	.....	
4,000	4,000	.000180	.000055	.....	.....	
5,000	5,000	.000260	.000080	.000005	.000005	
6,000	6,000	.000310	.000050	.....	.....	
7,000	7,000	.000370	.000060	.....	.....	
8,000	8,000	.000445	.000075	.....	.....	
9,000	9,000	.000515	.000070	.....	.....	
10,000	10,000	.000600	.000085	.000035	.000030	
11,000	11,000	.000670	.000070	.....	.....	
12,000	12,000	.000760	.000090	.000060	.000025	
13,000	13,000	.000860	.000100	.....	.....	
14,000	14,000	.000955	.000095	.000105	.000045	
15,000	15,000	.001040	.000085	.....	.....	
16,000	16,000	.001160	.000120	.000170	.000065	
17,000	17,000	.001285	.000125	.....	.....	
18,000	18,000	.001430	.000145	.000285	.000115	
19,000	19,000	.001590	.000160	.....	.....	
20,000	20,000	.001785	.000195	.000460	.000175	
21,000	21,000	.002000	.000215	.....	.....	
22,000	22,000	.002265	.000265	.000755	.000295	
23,000	23,000	.002585	.000320	.....	.....	
24,000	24,000	.002950	.000365	.001250	.000495	
25,000	25,000	.003425	.000475	.001610	.000360	
27,240	27,240	.....	.....	.....	.....	Tensile strength.

Fractured at middle of stem.
Appearance uniform granular.

No. 952.

Marks, $\frac{12\ M\ R_3\ T\ R_2}{B\ T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00014	.00008	.....	.....	
4,000	4,000	.00020	.00006	.....	.....	
5,000	5,000	.00030	.00010	0.	.....	
6,000	6,000	.00036	.00006	.....	.....	
7,000	7,000	.00042	.00006	.....	.....	
8,000	8,000	.00048	.00006	.....	.....	
9,000	9,000	.00054	.00006	.....	.....	
10,000	10,000	.00060	.00006	.00005	.00005	
11,000	11,000	.00066	.00006	.....	.....	
12,000	12,000	.00074	.00008	.....	.....	
13,000	13,000	.00080	.00006	.....	.....	
14,000	14,000	.00086	.00006	.....	.....	
15,000	15,000	.00094	.00008	.00010	.00005	
16,000	16,000	.00100	.00006	.....	.....	
17,000	17,000	.00110	.00010	.....	.....	
18,000	18,000	.00116	.00006	.....	.....	
19,000	19,000	.00124	.00008	.....	.....	
20,000	20,000	.00132	.00008	.00018	.00008	
21,000	21,000	.00140	.00008	.....	.....	
22,000	22,000	.00150	.00010	.....	.....	
23,000	23,000	.00160	.00010	.....	.....	
24,000	24,000	.00170	.00010	.....	.....	
25,000	25,000	.00180	.00010	.00034	.00016	
26,000	26,000	.00190	.00010	.....	.....	
27,000	27,000	.00200	.00010	.....	.....	
28,000	28,000	.00214	.00014	.....	.....	
29,000	29,000	.00226	.00012	.....	.....	
30,000	30,000	.00240	.00014	.00066	.00032	
31,000	31,000	.00260	.00020	.....	.....	
32,000	32,000	.00276	.00016	.....	.....	
33,000	33,000	.00300	.00024	.....	.....	
34,000	34,000	.00320	.00020	.....	.....	
35,000	35,000	.00352	.00032	.00144	.00078	
36,000	36,000	.00384	.00026	.....	.....	
37,000	37,000	.00410	.00026	.....	.....	
38,000	38,000	.00446	.00036	.....	.....	
39,000	39,000	.00494	.00048	.....	.....	
40,000	40,000	.00540	.00046	.00314	.00170	
41,000	41,000	.00586	.00046	.....	.....	
42,000	42,000	.00626	.00040	.....	.....	
43,000	43,000	.00666	.00040	.....	.....	
44,000	44,000	.00716	.00050	.....	.....	
45,000	45,000	.00778	.00062	.00516	.00202	
46,000	46,000	.00820	.00042	.....	.....	
47,000	47,000	.00846	.00026	.....	.....	
48,000	48,000	.00880	.00034	.....	.....	
49,000	49,000	.00918	.00038	.....	.....	
50,000	50,000	.00970	.00052	.00700	.00184	
55,060	55,060	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 953.

Marks, $\frac{12\ M\ R_3\ T\ R_2}{B\ R_{10}}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00008	.00008	.....	.....	
3,000	3,000	.00016	.00008	.....	.....	
4,000	4,000	.00022	.00006	.....	.....	
5,000	5,000	.00028	.00006	.00002	.00002	
6,000	6,000	.00036	.00008	.....	.....	
7,000	7,000	.00040	.00004	.....	.....	
8,000	8,000	.00046	.00006	.....	.....	
9,000	9,000	.00052	.00006	.....	.....	
10,000	10,000	.00058	.00006	.00004	.00002	
11,000	11,000	.00064	.00006	.....	.....	
12,000	12,000	.00070	.00006	.....	.....	
13,000	13,000	.00078	.00008	.....	.....	
14,000	14,000	.00084	.00006	.....	.....	
15,000	15,000	.00090	.00006	.00008	.00004	
16,000	16,000	.00098	.00008	.....	.....	
17,000	17,000	.00106	.00008	.....	.....	
18,000	18,000	.00114	.00008	.....	.....	
19.000	19,000	.00122	.00008	.....	.....	
20,000	20,000	.00130	.00008	.00016	.00008	
21,000	21,000	.00138	.00008	.....	.....	
22,000	22,000	.00144	.00006	.....	.....	
23,000	23,000	.00156	.00012	.....	.....	
24,000	24,000	.00164	.00008	.....	.....	
25,000	25,000	.00176	.00012	.00036	.00020	
26,000	26,000	.00188	.00012	.....	.....	
27,000	27,000	.00200	.00012	.....	.....	
28,000	28,000	.00212	.00012	.....	.....	
29,000	29,000	.00226	.00014	.....	.....	
30,000	30,000	.00250	.00024	.00084	.00048	
31,000	31,000	.00266	.00016	.....	.....	
32,000	32,000	.00288	.00022	.....	.....	
33,000	33.000	.00310	.00022	.....	.....	
34,000	34,000	.00344	.00034	.....	.....	
35,000	35,000	.00370	.00026	.00176	.00092	
36,000	36,000	.00420	.00050	.....	.....	
37,000	37,000	.00456	.00036	.....	.....	
38,000	38,000	.00506	.00050	.....	.....	
39,000	39,000	.00560	.00054	.....	.....	
40,000	40,000	.00634	.00074	.00406	.00230	
41,000	41,000	.00690	.00056	.....	.....	
42,000	42,000	.00770	.00080	.....	.....	
43,000	43,000	.00856	.00086	.....	.....	
44,000	44,000	.00950	.00094	.....	.....	
45,000	45,000	.01052	.00102	.00784	.00378	
53,480	53,480	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4560.

Marks, $\frac{12\,M\,R_3\,T\,R_1}{M\,T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 20″.
Length of stem, 23.″

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000060	.000060	.....	.....	
3,000	3,000	.000110	.000050	.....	.....	
4,000	4,000	.000165	.000055	.....	.....	
5,000	5,000	.000215	.000050	0.	.....	
6,000	6,000	.000270	.000055	.....	.....	
7,000	7,000	.000325	.000055	.....	.....	
8,000	8,000	.000385	.000060	.....	.....	
9,000	9,000	.000445	.000060	.....	.....	
10,000	10,000	.000505	.000060	.000015	.000015	
11,000	11,000	.000565	.000060	.....	.....	
12,000	12,000	.000635	.000070	.000040	.000025	
13,000	13,000	.000710	.000075	.....	.....	
14,000	14,000	.000780	.000070	.000065	.000025	
15,000	15,000	.000865	.000085	.....	.....	
16,000	16,000	.000940	.000075	.000110	.000045	
17,000	17,000	.001035	.000095	.....	.....	
18,000	18,000	.001135	.000100	.000165	.00055	
19,000	19,000	.001240	.000105	.....	.....	
20,000	20,000	.001350	.000110	000255	.000090	
21,000	21,000	.001490	.000140	.....	.....	
22,000	22,000	.001585	.000095	.000400	.000145	
23,000	23,000	.001845	.000260	.....	.....	Tensile strength.

Fractured 2½″ from neck at spongy spot.
Appearance uniform granular, excepting sponginess above noted.

No. 954.

Marks, $\frac{12\,M\,R_3\,T\,R_1}{M\,T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00014	.00008	.....	.....	
4,000	4,000	.00020	.00006	.....	.....	
5,000	5,000	.00026	.00006	0.	0.	
6,000	6,000	.00032	.00006	.....	.....	
7,000	7,000	.00038	.00006	.....	.....	
8,000	8,000	.00044	.00006	.....	.....	
9,000	9,000	.00050	.00006	.....	.....	
10,000	10,000	.00056	.00006	.00002	.00002	
11,000	11,000	.00062	.00006	.....	.....	
12,000	12,000	.00068	.00006	.....	.....	
13,000	13,000	.00074	.00006	.....	.....	
14,000	14,000	.00082	.00008	.....	.....	
15,000	15,000	.00088	.00006	.00006	.00004	
16,000	16,000	.00098	.00010	.....	.....	
17,000	17,000	.00104	.00006	.....	.....	
18,000	18,000	.00112	.00008	.....	.....	
19,000	19,000	.00118	.00006	.....	.....	
20,000	20,000	.00126	.00008	.00016	.00010	
21,000	21,000	.00134	.00008	.....	.....	
22,000	22,000	.00142	.00008	.....	.....	
23,000	23,000	.00150	.00008	.....	.....	
24,000	24,000	.00160	.00010	.....	.....	
25,000	25,000	.00170	.00010	.00030	.00014	
26,000	26,000	.00180	.00010	.....	.....	
27,000	27,000	.00190	.00010	.....	.....	
28,000	28,000	.00200	.00010	.....	.....	
29,000	29,000	.00214	.00014	.....	.....	
30,000	30,000	.00228	.00014	.00062	.00032	
31,000	31,000	.00246	.00018	.....	.....	
32,000	32,000	.00260	.00014	.....	.....	
33,000	33,000	.00278	.00018	.....	.....	
34,000	34,000	.00300	.00022	.....	.....	
35,000	35,000	.00326	.00026	.00130	.00068	
36,000	36,000	.00358	.00032	.....	.....	
37,000	37,000	.00384	.00026	.....	.....	
38,000	38,000	.00410	.00026	.....	.....	
39,000	39,000	.00454	.00044	.....	.....	
40,000	40,000	.00500	.00046	.00276	.00146	
41,000	41,000	.00532	.00032	.....	.....	
42,000	42,000	.00576	.00044	.....	.....	
43,000	43,000	.00616	.00040	.....	.....	
44,000	44,000	.00658	.00042	.....	.....	
45,000	45,000	.00680	.00022	.00434	.00158	
55,200	55,200	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

Hoop A_4.—Mortar No. 4.

No. 4348.

Marks, $\frac{12\,M\,R_4\,A_4}{T_1\,O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	0.	.....	
2,500	10,000	.000250	.000125	.....	.....	
5,000	20,000	.000550	.000300	.....	.....	
7,500	30,000	.000875	.000325	.....	.....	
10,000	40,000	.001225	.000350	.....	.....	
11,250	45,000	.001375	.000150	0.	.....	
12,500	50,000	.001550	.000175	0.	.....	
12,750	51,000	.001575	.000025	.....	.....	
13,000	52,000	.001625	.000050	.....	.....	
13,250	53,000	.001700	.000075	.....	.....	
13,500	54,000	.001725	.000025	.....	.....	
13,750	55,000	.001750	.000025	.....	.....	Elastic limit.
14,000	56,000	.001900	.000150	.....	.....	
14,250	57,000	.002050	.000150	.....	.....	
14,500	58,000	.002475	.000425	.....	.....	
14,750	59,000	.002950	.000475	.....	.....	
15,000	60,000	.004300	.001350	.....	.....	
24,790	99,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	99,600
Elastic limit per square inch of original section	do...	55,000
Elongation per inch after rupture	inch..	.1725
Elongation per inch under strain at elastic limit	do...	.001750
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		2″ from the neck
Character of broken surface		granular, dull eccentric spot
Elongation of inch sections		″.10, ″.16, ″.31*, ″.12

Hoop A_4.—Mortar No. 18.

No. 4277.

Marks, $\overset{12\,M\,R_{18}\,A_4}{T_1\,O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	0.	.....	
2,500	10,000	.000375	.000250	.....	.....	
5,000	20,000	.000750	.000375	.....	.....	
7,500	30,000	.001100	.000350	.....	.....	
10,000	40,000	.001400	.000300	.....	.....	
11,250	45,000	.001650	.000250	.000025	.000025	
12,500	50,000	.001775	.000125	.000025	0.	
12,750	51,000	.001800	.000025	.....	.....	
13,000	52,000	.001825	.000025	.....	.....	
13,250	53,000	.001850	.000025	.....	.....	
13,500	54,000	.001875	.000025	.....	.....	
13,750	55,000	.001900	.000025	.....	.....	
14,000	56,000	.001950	.000050	.....	.....	
14,250	57,000	.002000	.000050	.....	.....	
14,500	58,000	.002025	.000025	.....	.....	
14,750	59,000	.002050	.000025	.....	.....	
15,000	60,000	.002100	.000050	.....	.....	
15,250	61,000	.002150	.000050	.....	.....	
15,500	62,000	.002200	.000050	.....	.....	Elastic limit.
15,750	63,000	.002300	.000100	.....	.....	
16,000	64,000	.002475	.000175	.....	.....	
16,250	65,000	.002625	.000150	.....	.....	
16,750	67,000	.003550	.000925	.....	.....	
17,250	69,000	.005375	.001825	.....	.....	
17,750	71,000	.007425	.002050	.....	.....	
18,250	73,000	.009200	.001775	.....	.....	
18,750	75,000	.011300	.002100	.....	.....	
26,760	107,040	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	107,040
Elastic limit per square inch of original section	do	62,000
Elongation per inch after rupture	inch	.1600
Elongation per inch under strain at elastic limit	do	.002200
Reduction in diameter at point of rupture	do	.094
Reduction in area after rupture, per cent of original section		30.6
Position of rupture		1″.25 from the neck
Character of broken surface		granular, dull silky spot at the circumference
Elongation of inch sections		″.14, ″.25*, ″.15, ″.10

Hoop B_1.—Mortar No. 19.

No. 4272.

Marks, $^{12\ M\ R_{19}\ B_1}_{T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000075	.000075	0.	.....	
2,500	10,000	.000275	.000200	.....	.....	
5,000	20,000	.000675	.000400	.....	.....	
7,500	30,000	.001000	.000325	.....	.....	
10,000	40,000	.001400	.000400	.....	.....	
11,250	45,000	.001500	.000100	.000025	.000025	
12,500	50,000	.001725	.000225	.000025	0.	
12,750	51,000	.001750	.000025	.....	.....	
13,000	52,000	.001800	.000050	.....	.....	
13,250	53,000	.001825	.000025	.....	.....	
13,500	54,000	.001850	.000025	.....	.....	
13,750	55,000	.001900	.000050	.....	.....	
14,000	56,000	.001950	.000050	.....	.....	
14,250	57,000	.001975	.000025	.....	.....	
14,500	58,000	.002025	.000050	.....	.....	
14,750	59,000	.002050	.000025	.....	.....	
15,000	60,000	.002075	.000025	.....	.....	
15,250	61,000	.002125	.000055	.....	.....	
15,500	62,000	.002175	.000050	.....	.....	
15,750	63,000	.002225	.000050	.....	.....	
16,000	64,000	.002300	.000075	.....	.....	Elastic limit.
16,250	65,000	.002425	.000125	.....	.....	
16,500	66,000	.002550	.000125	.....	.....	
16,750	67,000	.002775	.000225	.....	.....	
17,250	69,000	.004025	.001250	.....	.....	
17,750	71,000	.006375	.002350	.....	.....	
18,250	73,000	.008500	.002125	.....	.....	
18,750	75,000	.010000	.001500	.....	.....	
19,250	77,000	.011750	.001750	.....	.....	
27,410	109,640	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	109,640
Elastic limit per square inch of original section	do...	64,000
Elongation per inch after rupture	inch..	.1475
Elongation per inch under strain at elastic limit	do...	.002300
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		2″ from the neck
Character of broken surface		granular, dull spot near the circumference.
Elongation of inch sections		″.09, ″.27*, ″.13, ″.10

Hoop A_4—Mortar No. 20.

No. 4273.

Marks, $\overset{12\,M\,R_{20}\,A_4}{T_1\,O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000325	.000225	.....	.....	
5,000	20,000	.000700	.000375	.....	.....	
7,500	30,000	.001100	.000400	.....	.....	
10,000	40,000	.001425	.000325	.....	.....	
11,250	45,000	.001625	.000200	.000075	.000075	
12,500	50,000	.001800	.000175	.000075	0.	
12,750	51,000	.001850	.000050	.....	.....	
13,000	52,000	.001875	.000025	.....	.....	
13,250	53,000	.001900	.000025	.....	.....	
13,500	54,000	.001925	.000025	.....	.....	
13,750	55,000	.001950	.000025	.....	.....	
14,000	56,000	.002000	.000050	.....	.....	
14,250	57,000	.002050	.000050	.....	.....	
14,500	58,000	.002100	.000050	.....	.....	
14,750	59,000	.002150	.000050	.....	.....	
15,000	60,000	.002175	.000025	.....	.....	
15,250	61,000	.002200	.000025	.....	.....	Elastic limit.
15,500	62,000	.002325	.000125	.....	.....	
15,750	63,000	.002400	.000075	.....	.....	
16,000	64,000	.002475	.000075	.....	.....	
16,500	66,000	.002800	.000325	.....	.....	
17,000	68,000	.003300	.000500	.....	.....	
17,500	70,000	.004825	.001525	.....	.....	
18,000	72,000	.006675	.001850	.....	.....	
27,890	111,560	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	111,560
Elastic limit per square inch of original section	do...	61,000
Elongation per inch after rupture	inch..	.1325
Elongation per inch under strain at elastic limit	do...	.002200
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		″2.1 from the neck
Character of broken surface		granular, silky center
Elongation of inch sections		″.07, ″.22*, ″.15, ″.09

Hoop B_1—Mortar No. 20.

No. 4270.

Marks, $\overset{12\ M\ R_{20}\ B_1}{T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000050	.000050	0.	.....	
2,500	10,000	.000225	.000175	.....	.....	
5,000	20,000	.000500	.000275	.....	.....	
7,500	30,000	.000825	.000325	.....	.....	
10,000	40,000	.001225	.000400	.....	.....	
11,250	45,000	.001450	.000225	0.	.....	
12,500	50,000	.001550	.000100	0.	.....	
12,750	51,000	.001575	.000025	.....	.....	
13,000	52,000	.001600	.000025	.....	.....	
13,250	53,000	.001650	.000050	.....	.....	
13,500	54,000	.001725	.000075	.....	.....	
13,750	55,000	.001750	.000025	.....	.....	
14,000	56,000	.001800	.000050	.....	.....	
14,250	57,000	.001825	.000025	.....	.....	
14,500	58,000	.001875	.000050	.....	.....	
14,750	59,000	.001925	.000050	.....	.....	
15,000	60,000	.001975	.000050	.....	.....	
15,250	61,000	.002025	.000050	.....	.....	
15,500	62,000	.002050	.000025	.....	.....	Elastic limit.
15,750	63,000	.002150	.000100	.....	.....	
16,000	64,000	.002450	.000300	.....	.....	
16,250	65,000	.002725	.000275	.....	.....	
16,750	67,000	.004375	.001650	.....	.....	
17,250	69,000	.006050	.001675	.....	.....	
17,750	71,000	.008025	.001975	.....	.....	
18,250	73,000	.009550	.001525	.....	.....	
18,750	75,000	.011300	.001750	.....	.....	
27,270	109,080	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	190,080
Elastic limit per square inch of original section	do...	62,000
Elongation per inch after rupture	inch..	.1775
Elongation per inch under strain at elastic limit	do...	.002050
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		2″ from the neck
Character of broken surface		silky
Elongation of inch sections		″.10, ″.14, ″.35,* ″.12

Hoop A_6.—Mortar No. 21.

No. 4275.

Marks, $\frac{12\ M\ R_{21}\ A_6}{T_1\ O.}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000150	.000150	0.	.....	
2,500	10,000	.000300	.000150	.....	.....	
5,000	20,000	.000675	.000375	.....	.....	
7,500	30,000	.001025	.000350	.....	.....	
10,000	40,000	.001400	.000375	.....	.....	
11,250	45,000	.001550	.000150	0.	.....	
12,500	50,000	.001725	.000175	0.	.....	
12,750	51,000	.001750	.000025	.....	.....	
13,000	52,000	.001775	.000025	.....	.....	
13,250	53,000	.001800	.000025	.....	.....	
13,500	54,000	.001825	.000025	.....	.....	
13,750	55,000	.001875	.000050	.....	.....	
14,000	56,000	.001925	.000050	.....	.....	
14,250	57,000	.002000	.000075	.....	.....	
14,500	58,000	.002025	.000025	.....	.....	
14,750	59,000	.002050	.000025	.....	.....	Elastic limit.
15,000	60,000	.002200	.000150	.....	.....	
15,250	61,000	.002300	.000100	.....	.....	
15,500	62,000	.002875	.000575	.....	.....	
16,000	64,000	.004625	.001750	.....	.....	
16,500	66,000	.006875	.002250	.....	.....	
17,000	68,000	.008625	.001750	.....	.....	
17,500	70,000	.010750	.002150	.....	.....	
18,000	72,000	.012875	.002125	.....	.....	
25,470	101,880	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	101,880
Elastic limit per square inch of original section	do	59,000
Elongation per inch after rupture	inch	.1650
Elongation per inch under strain at elastic limit	do	.002050
Reduction in diameter at point of rupture	do	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.85 from the neck
Character of broken surface		fine granular, silky spot at the circumference
Elongation of inch sections		″.11, ″.31*, ″.13, ″.11

Hoop B_1—Mortar No. 21.

No. 4271.

Marks, $\frac{12\,M\,R_{21}\,B_1}{T_1\,O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000250	.000150	.....	.....	
5,000	20,000	.000550	.000300	.....	.....	
7,500	30,000	.000975	.000425	.....	.....	
10,000	40,000	.001275	.000300	.....	.....	
11,250	45,000	.001475	.000200	0.	.....	
12,500	50,000	.001650	.000175	0.	.....	
12,750	51,000	.001700	.000050	.....	.....	
13,000	52,000	.001750	.000050	.....	.....	
13,250	53,000	.001775	.000025	.....	.....	
13,500	54,000	.001800	.000025	.....	.....	
13,750	55,000	.001850	.000050	.....	.....	
14,000	56,000	.001900	.000050	.....	.....	
14,250	57,000	.001950	.000050	.....	.....	
14,500	58,000	.002025	.000075	.....	.....	Elastic limit.
14,750	59,000	.002175	.000150	.....	.....	
15,000	60,000	.002800	.000625	.....	.....	
15,250	61,000	.003500	.000700	.....	.....	
15,750	63,000	.006000	.002500	.....	.....	
16,250	65,000	.008175	.002175	.....	.....	
16,750	67,000	.009975	.001800	.....	.....	
17,250	69,000	.011575	.001600	.....	.....	
17,750	71,000	.013775	.002200	.....	.....	
25,360	101,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	101,440
Elastic limit per square inch of original section	do	58,000
Elongation per inch after rupture	inch	.1825
Elongation per inch under strain at elastic limit	do	.002025
Reduction in diameter at point of rupture	do	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.90 from the neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.37*, ″.15, ″.09

HOOP A_4.—MORTAR NO. 22.

No. 4276.

Marks, $\overset{12\ M\ R_{22}\ A_4}{T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000375	.000275	.....	.....	
5,000	20,000	.000750	.000375	.....	.....	
7,500	30,000	.001025	.000275	.....	.....	
10,000	40,000	.001400	.000375	.....	.....	
11,250	45,000	.001550	.000150	.000025	.000025	
12,500	50,000	.001725	.000175	.000025	0.	
12,750	51,000	.001750	.000025	.....	.....	
13,000	52,000	.001775	.000025	.....	.....	
13,250	53,000	.001800	.000025	.....	.....	
13,500	54,000	.001850	.000050	.....	.....	
13,750	55,000	.001900	.000050	.....	.....	
14,000	56,000	.001950	.000050	.....	.....	
14,250	57,000	.001975	.000025	.....	.....	
14,500	58,000	.002000	.000025	.....	.....	
14,750	59,000	.002025	.000025	.....	.....	
15,000	60,000	.002075	.000050	.....	.....	
15,250	61,000	.002125	.000050	.....	.....	
15,500	62,000	.002175	.000050	.....	.....	
15,750	63,000	.002250	.000075	.....	.....	
16,000	64,000	.002300	.000050	.....	.....	Elastic limit.
16,250	65,000	.002425	.000125	.....	.....	
16,500	66,000	.002525	.000100	.....	.....	
16,750	67,000	.002800	.000275	.....	.....	
17,250	69,000	.003500	.000700	.....	.....	
17,750	71,000	.005625	.002125	.....	.....	
18,250	73,000	.007625	.002000	.....	.....	
18,750	75,000	.009500	.001875	.....	.....	
19,250	77,000	.011000	.001500	.....	.....	
27,440	109,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	109,760
Elastic limit per square inch of original section	do...	64,000
Elongation per inch after rupture	inch..	.1525
Elongation per inch under strain at elastic limit	do...	.002300
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		2″ from the neck
Character of broken surface		silky, granular at the circumference
Elongation of inch sections		″.07, ″.12, ″.31*, ″.11

Hoop A_4—Mortar No. 23.

No. 4274.

Marks, $\begin{matrix}12\ M\ R_{23}\ A_4\\ T_4\ O\end{matrix}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000400	.000300	.....	.....	
5,000	20,000	.000650	.000250	.....	.....	
7,500	30,000	.001300	.000650	.000150	.000150	
10,000	40,000	.001675	.000375	.....	.....	
11,250	45,000	.001800	.000125	.000150	0.	
12,500	50,000	.002000	.000200	.000200	.000050	
12,750	51,000	.002050	.000050	.....	.....	
13,000	52,000	.002100	.000050	.....	.....	
13,250	53,000	.002150	.000050	.....	.....	
13,500	54,000	.002225	.000075	.....	.....	
13,750	55,000	.002275	.000050	.....	.....	Elastic limit.
14,000	56,000	.002450	.000175	.....	.....	
14,250	57,000	.002625	.000175	.....	.....	
14,500	58,000	.003025	.000400	.....	.....	
15,000	60,000	.004775	.001750	.....	.....	
15,500	62,000	.006550	.001775	.....	.....	
16,000	64,000	.008250	.001700	.....	.....	
16,500	66,000	.009875	.001625	.....	.....	
17,000	68,000	.011750	.001875	.....	.....	
25,570	102,280	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	102,280
Elastic limit per square inch of original section	do...	55,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.002275
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.9 from the neck
Character of broken surface		silky, interspersed with fine granulation at the circumference
Elongation of inch sections		″,12″.36*,″.16,″.12

Hoop A_4—Mortar No. 25.

No. 4318.

Marks, $\overset{12\ M\ R_{25}\ A_4}{T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	0.	.....	
2,500	10,000	.000375	.000250	.....	.....	
5,000	20,000	.000750	.000375	.....	.....	
7,500	30,000	.001125	.000375	.....	.....	
10,000	40,000	.001500	.000375	.....	.....	
11,250	45,000	.001650	.000150	.000050	.000050	
12,500	50,000	.001775	.000125	.000050	0.	
12,750	51,000	.001800	.000025	.....	.....	
13,000	52,000	.001800	0.	.....	.....	
13,250	53,000	.001825	.000025	.....	.....	
13,500	54,000	.001875	.000050	.....	.....	
13,750	55,000	.001925	.000050	.....	.....	
14,000	56,000	.001950	.000025	.....	.....	
14,250	57,000	.002000	.000050	.....	.....	
14,500	58,000	.002050	.000050	.....	.....	
14,750	59,000	.002075	.000025	.....	.....	Elastic limit.
15,000	60,000	.002200	.000125	.....	.....	
15,250	61,000	.002300	.000100	.....	.....	
15,500	62,000	.002525	.000225	.....	.....	
15,750	63,000	.002875	.000350	.....	.....	
16,000	64,000	.003775	.000900	.....	.....	
26,410	105,640	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	105,640
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch..	.1550
Elongation per inch under strain at elastic limit	do...	.002075
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″ from the neck
Character of broken surface		granular, silky center
Elongation of inch sections		″.23*, ″.17, ″.12, ″.10

HOOP A_4—MORTAR NO. 26.

No. 4343.

Marks, $^{12\,M\,R_{26}\,A_4}_{T_1\,O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000150	.000150	0.	.....	
2,500	10,000	.000400	.000250	.....	.....	
5,000	20,000	.000750	.000350	.....	.....	
7,500	30,000	.001050	.000300	.....	.....	
10,000	40,000	.001375	.000325	.....	.....	
11,250	45,000	.001550	.000175	.000025	.000025	
12,500	50,000	.001700	.000150	.000025	0.	
12,750	51,000	.001725	.000025	.....	.....	
13,000	52,000	.001775	.000050	.....	.....	
13,250	53,000	.001800	.000025	.....	.....	
13,500	54,000	.001850	.000050	.....	.....	
13,750	55,000	.001900	.000050	.....	.....	
14,000	56,000	.001975	.000075	.....	.....	
14,250	57,000	.002025	.000050	.....	.....	
14,500	58,000	.002100	.000075	.....	.....	Elastic limit.
14,750	59,000	.002250	.000150	.....	.....	
15,000	60,000	.002400	.000150	.....	.....	
15,250	61,000	.002750	.000350	.....	.....	
15,500	62,000	.003200	.000450	.....	.....	
15,750	63,000	.004125	.000925	.....	.....	
26,590	106,360	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	106,360
Elastic limit per square inch of original section	do...	58,000
Elongation per inch after rupture	inch..	.1525
Elongation per inch under strain at elastic limit	do...	.002100
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		2″.1 from the neck
Character of broken surface		granular, silky center
Elongation of inch sections		″.10, ″.14, ″.26*, ″.11

Hoop A_4—Mortar No. 27.

No. 4345.

Marks, $^{12\ M\ R_{27}\ A_4}_{T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000150	.000150	0.	.....	
2,500	10,000	.000400	.000250	.....	.....	
5,000	20,000	.000700	.000300	.....	.....	
7,500	30,000	.001050	.000350	.....	.....	
10,000	40,000	.001350	.000300	.....	.....	
11,250	45,000	.001525	.000175	.000050	.000050	
12,500	50,000	.001700	.000175	.000050	0.	
12,750	51,000	.001750	.000050	.....	.....	
13,000	52,000	.001775	.000025	.....	.....	
13,250	53,000	.001800	.000025	.....	.....	
13,500	54,000	.001825	.000025	.....	.....	
13,750	55,000	.001875	.000050	.....	.....	
14,000	56,000	.001900	.000025	.....	.....	
14,250	57,000	.001950	.000050	.....	.....	
14,500	58,000	.002000	.000050	.....	.....	
14,750	59,000	.002050	.000050	.....	.....	Elastic limit.
15,000	60,000	.002225	.000175	.....	.....	
15,250	61,000	.002375	.000150	.....	.....	
15,500	62,000	.002700	.000325	.....	.....	
15,750	63,000	.003200	.000500	.....	.....	
16,000	64,000	.003950	.000750	.....	.....	
26,550	106,200	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	106,200
Elastic limit per square inch of original section	do	59,000
Elongation per inch after rupture	inch	.1675
Elongation per inch under strain at elastic limit	do	.002050
Reduction in diameter at point of rupture	do	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1″.8 from the neck
Character of broken surface		granular, silky center
Elongation of inch sections		″.11, ″.29*, ″.15, ″.12

Hoop A_4—Mortar No. 28.

No. 4344.

Marks, $^{12\,M\,R_{28}\,A_4}_{T_1\,O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000125	.000125	0.	.....	
2,500	10,000	.000375	.000250	.....	.....	
5,000	20,000	.000625	.000250	.....	.....	
7,500	30,000	.000900	.000275	.....	.....	
10,000	40,000	.001225	.000325	.....	.....	
11,250	45,000	.001375	.000150	0.	.....	
12,500	50,000	.001550	.000175	0.	.....	
12,750	51,000	.001600	.000050	.....	.....	
13,000	52,000	.001625	.000025	.....	.....	
13,250	53,000	.001675	.000050	.....	.....	
13,500	54,000	.001700	.000025	.....	.....	
13,750	55,000	.001750	.000050	.....	.....	
14,000	56,000	.001775	.000025	.....	.....	
14,250	57,000	.001800	.000025	.....	.....	
14,500	58,000	.001875	.000075	.....	.....	
14,750	59,000	.001950	.000075	.....	.....	
15,000	60,000	.002000	.000050	.....	.....	Elastic limit.
15,250	61,000	.002100	.000100	.....	.....	
15,500	62,000	.002350	.000250	.....	.....	
15,750	63,000	.002750	.000400	.....	.....	
16,000	64,000	.003500	.000750	.....	.....	
16,250	65,000	.004275	.000775	.....	.....	
26,590	106,360	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	106,360
Elastic limit per square inch of original section	do	60,000
Elongation per inch after rupture	inch	.1750
Elongation per inch under strain at elastic limit	do	.002000
Reduction in diameter at point of rupture	do	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.28 from the neck
Character of broken surface		silky, interspersed with granular metal at the circumference
Elongation of inch sections		″.21, ″.25*, ″.14, ″.10

Hoop A_4—Mortar No. 29.

No. 4352.

Marks, $\overset{12\ M\ R_{29}\ A_4}{T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000050	.000050	0.	.....	
2,500	10,000	.000200	.000150	.....	.....	
5,000	20,000	.000425	.000225	.....	.....	
7,500	30,000	.000725	.000300	.....	.....	
10,000	40,000	.001100	.000375	.....	.....	
11,250	45,000	.001250	.000150	0.	.....	
12,500	50,000	.001550	.000300	0.	.....	
12,750	51,000	.001600	.000050	.....	.....	
13,000	52,000	.001675	.000075	.....	.....	
13,250	53,000	.001725	.000050	.....	.....	
13,500	54,000	.001750	.000025	.....	.....	
13,750	55,000	.001775	.000025	.....	.....	
14,000	56,000	.001800	.000025	.....	.....	
14,250	57,000	.001825	.000025	.....	.....	
14,500	58,000	.001900	.000075	.....	.....	
14,750	59,000	.001950	.000050	.....	.....	
15,000	60,000	.002000	.000050	.....	.....	
15,250	61,000	.002025	.000025	.....	.....	
15,500	62,000	.002075	.000050	.....	.....	Elastic limit.
15,750	63,000	.002175	.000100	.....	.....	
16,000	64,000	.002300	.000125	.....	.....	
16,250	65,000	.002450	.000150	.....	.....	
16,500	66,000	.002800	.000350	.....	.....	
16,750	67,000	.003075	.000275	.....	.....	
28,230	112,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	112,920
Elastic limit per square inch of original section	do...	62,000
Elongation per inch after rupture	inch..	.1650
Elongation per inch under strain at elastic limit	do...	.002075
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		2″ from the neck
Character of broken surface		granular, silky center
Elongation of inch sections		″.09, ″.16, ″.29*, ″.12

Hoop A_4—Mortar No. 30.

No. 4349.

Marks, $\overset{12\ M\ R_{30}\ A_4}{T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000150	.000150	0.	.....	
2,500	10,000	.000325	.000175	.....	.....	
5,000	20,000	.000700	.000375	.....	.....	
7,500	30,000	.001050	.000350	.....	.....	
10,000	40,000	.001425	.000375	.....	.....	
11,250	45,000	.001575	.000150	0.	.....	
12,500	50,000	.001775	.000200	.000025	.000025	
12,750	51,000	.001800	.000025	.....	.....	
13,000	52,000	.001825	.000025	.....	.....	
13,250	53,000	.001875	.000050	.....	.....	
13,500	54,000	.001925	.000050	.....	.....	
13,750	55,000	.001950	.000025	.....	.....	
14,000	56,000	.002000	.000050	.....	.....	
14,250	57,000	.002025	.000025	.....	.....	
14,500	58,000	.002075	.000050	.....	.....	
14,750	59,000	.002125	.000050	.....	.....	
15,000	60,000	.002175	.000050	.....	.....	
15,250	61,000	.002225	.000050	.....	.....	
15,500	62,000	.002275	.000050	.....	.....	
15,750	63,000	.002300	.000025	.....	.....	Elastic limit.
16,000	64,000	.002425	.000125	.....	.....	
16,250	65,000	.002525	.000100	.....	.....	
16,500	66,000	.002675	.000150	.....	.....	
16,750	67,000	.002825	.000150	.....	.....	
17,000	68,000	.003250	.000425	.....	.....	
27,110	108,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	108,440
Elastic limit per square inch of original section	do	63,000
Elongation per inch after rupture	inch	.1325
Elongation per inch under strain at elastic limit	do	.002300
Reduction in diameter at point of rupture	do	.084
Reduction in area after rupture, per cent of original section		27.6
Position of rupture		″.90 from the neck
Character of broken surface		granular, small dull eccentric spot
Elongation of inch sections		″.19,* ″.15, ″.10, ″.09

12-INCH B. L. RIFLED MORTARS.

Specific Gravity and Hardness of Steel Hoops.

[No tension tests of these specimens.]

Number of mortar.	Marks.	Specific gravity.	Hardness.	Remarks.
15	12 M R_{15} A_3 R_4 M	7.8459	24.26	
16	12 M R_{16} A_4 R_4 M	7.8429	20.81	
18	12 M R_{18} B_1 R_5 M	7.8450	20.59	
19	12 M R_{19} B_1 R_6 M	7.8509	26.04	
20	12 M R_{20} B_1 R_5 M	7.8476	24.69	
21	12 M R_{21} B_1 R_5 M	7.8432	20.47	
22	12 M R_{22} A_4 R_4 M	7.8490	25.73	
28	12 M R_{28} B_4 R_1 M	7.8341	23.17	
29	12 M R_{29} A_4 T_4 O	7.8389	25.73	Prolongation of tensile specimen.
29	12 M R_{29} A_4 T_4 O	7.8452	24.26	From tensile specimen.
30	12 M R_{30} B_5 R_1 M	7.8378	21.52	
41	12 M R_{41} B_4 R_1 M	7.8408	21.77	
42	12 M R_{42} B_1 R_1 M	7.8385	20.14	
44	12 M R_{44} B_4 R_1 M	7.8373	23.84	
45	12 M R_{45} B_4 R_1 M	7.8384	23.70	

Of the two specimens taken from hoop A_4 for 12-inch mortar No. 29, that from the fractured tensile specimen was turned down from the 1-inch threaded end after the tensile test was completed. Its dimensions were ″.97 long by ″.78 diameter.

The other specimen was 1″ long by 1″ diameter.

The comparative hardness was affected by the bulging of the sides of the smaller specimen when the cut for hardness was made; the specimen bulging about ″.002 ∓ in diameter due the flow of the metal from the vicinity of the cut. The larger specimen changed less than ″.001 in diameter.

12-INCH B. L. RIFLED MORTARS.

TABULATION OF TENSION SPECIMENS FROM CAST-IRON BODIES.

No. of test.	Number of.		Position in body.	Location of specimen.	Length of stem.	Sectional area.	Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.	Remarks.
	Mortar.	Specimen.									
					Inches.	*Sq. inch.*	*Pounds.*				
4335	------	1	----------	----------	Grooved ..	1.00	37,240	Granular	7.3431	17.62	Cast-iron trial cylinder.
4336	------	2	----------	----------	----do -----	1.00	32,480	------do	7.3355	15.91	
4337	------	3	----------	----------	----do -----	1.00	37,820	------do	7.3392	17.08	
4338	------	4	----------	----------	----do -----	1.00	31,360	------do	7.3503	16.73	
4339	------	5	----------	----------	----do -----	1.00	35,910	------do	----------	---------	
4340	------	6	----------	----------	----do -----	1.00	36,870	------do	----------	---------	
4411	------	10	----------	----------	23	1.00	34,520	Uniform granular	----------	---------	
4412	------	11	----------	----------	19.5	1.01	34,730	------do	----------	---------	
4549	1	1	Breech-----	Inside -----	23	1.00	30,040	------do	----------	---------	
4348	1	3	----do -----	----do -----	Grooved ..	1.00	30,980	------do	7.3207	14.19	
4349	1	4	----do -----	Outside-----	----do -----	1.00	34,510	------do	7.3183	14.33	
4350	1	5	----do -----	----do -----	----do -----	1.00	33,260	------do	7.3127	14.19	
4351	1	6	--- do -----	Inside -----	----do -----	1.00	29,980	------do	----------	---------	
4352	1	7	----do -----	----do -----	----do -----	1.00	30,700	------do	----------	---------	
4353	1	8	----do -----	Outside-----	----do -----	1.00	33,690	------do	----------	---------	
4354	1	9	----do -----	----do -----	----do -----	1.00	32,630	------do	----------	---------	
4550	1	1	Muzzle -----	Inside -----	23	1.00	28,360	------do	----------	---------	
4345	1	3	----do -----	----do -----	Grooved ..	1.00	36,390	------do	7.2827	17.26	
4346	1	4	----do -----	Outside-----	----do -----	1.00	34,420	------do	7.3272	16.73	
4347	1	5	----do -----	----do -----	----do -----	1.00	32,530	------do	7.3153	15.15	
4555	2	1	Breech-----	Inside -----	23	1.00	26,070	------do	----------	---------	
4362	2	3	----do -----	----do -----	Grooved ..	1.00	28,440	------do	7.3184	13.02	
4363	2	4	----do -----	Outside-----	----do -----	1.00	28,470	------do	7.3112	12.36	
4364	2	5	----do -----	----do -----	----do -----	1.00	32,450	------do	7.3134	12.60	
4365	2	6	----do -----	Inside -----	----do -----	1.00	31,210	------do	----------	---------	
4366	2	7	----do -----	----do -----	----do -----	1.00	28,560	------do	----------	---------	
4367	2	8	----do -----	Outside-----	----do -----	1.00	30,810	------do	----------	---------	
4368	2	9	----do -----	----do -----	----do -----	1.00	30,060	------do	----------	---------	
4556	2	1	Muzzle -----	Inside -----	23	1.00	31,050	------do	----------	---------	
4369	2	3	----do -----	----do -----	Grooved ..	1.00	32,120	------do	7.3178	14.54	
4370	2	4	----do -----	Outside-----	----do -----	1.00	33,430	------do	7.3209	14.98	
4371	2	5	----do -----	----do -----	----do -----	1.00	34,010	------do	7.3142	13.72	
4559	3	1	Breech-----	Inside -----	23	1.00	27,240	------do	----------	---------	
4375	3	3	----do -----	----do -----	Grooved ..	1.00	28,810	------do	7.2637	12.42	
4376	3	4	----do -----	Outside-----	----do -----	1.00	29,580	------do	7.2625	11.81	
4377	3	5	----do -----	----do -----	----do -----	1.00	32,040	------do	7.2535	11.81	
4378	3	6	----do -----	Inside -----	----do -----	1.00	31,870	------do	----------	---------	
4379	3	7	----do -----	----do -----	----do -----	1.00	29,950	------do	----------	---------	

TABULATION OF TENSION SPECIMENS FROM CAST-IRON BODIES—Continued.

No. of test.	Number of—		Position in body.	Location of specimen.	Length of stem.	Sectional area.	Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.	Remarks.
	Mortar.	Specimen.									
					Inches.	*Sq. inch.*	*Pounds.*				
4380	3	8	Breech	Outside	Grooved	1.00	31,100	Uniform granular			
4381	3	9	do	do	do	1.00	31,200	do			
4560	3	1	Muzzle	Inside	23	1.00	23,000	Uniform granular, spongy spot			
4382	3	3	do	do	Grooved	1.00	32,690	Uniform granular	7.2718	13.40	
4383	3	4	do	Outside	do	1.00	32,340	do	7.2685	12.60	
4384	3	5	do	do	do	1.00	31,200	do	7.2541	12.54	

12-INCH B. L. RIFLED MORTARS.

TABULATION OF COMPRESSION SPECIMENS FROM CAST IRON BODIES.

No. of test.	Number of		Position in body.	Location of specimen.	Total length.	Sectional area.	Ultimate strength per square inch.	Manner of failure.	Remarks.
	Mortar.	Specimen.							
						Sq. in.	*Pounds.*		
930	.....	14	.....	.....	10.5	.985	59,210	Triple flexure .	Cast iron trial cylinder.
931	.....	15	.....	.....	10.5	.983	59,140	....do	
932	.....	16	.....	.....	10.5	1.01	60,300	....do	
944	1	2	Breech..	Inside ..	10.5	.99	57,780	....do	
945	1	10	...do	Radial ..	10.5	.99	59,350	....do	
946	1	2	Muzzle .	Inside ..	10.5	1.00	66,180	....do	
949	2	2	Breech..	..do	10.5	1.00	57,080	....do	
950	2	10	...do	Radial ..	10.5	1.00	58,610	....do	
951	2	2	Muzzle .	Inside ..	10.5	1.00	62,350	....do	
952	3	2	Breech..	..do	10.5	1.00	55,060	....do	
953	3	10	...do	Radial ..	10.5	1.00	53,480	....do	
954	3	2	Muzzle .	Inside ..	10.5	1.00	55,200	....do	

TABULATION OF TENSION SPECIMENS FROM STEEL HOOPS.

[Stems 4 inches long, .564 inch diameter.]

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*P. ct.*	*P. ct.*		
4348	Hoop A_4	Outside.	55,000	99,160	17.3	39.2	Gr., dull spot	Mortar No. 4.
4277	Hoop A_4	Outside.	62,000	107,040	16.0	30.6	....do	Mortar No. 18.
4272	Hoop B_1	Outside.	64,000	109,640	14.8	33.5	....do	Mortar No. 19.
4273	Hoop A_4	Outside.	61,000	111,560	13.3	33.5	Gr., silky center..	Mortar No. 20.
4270	Hoop B_1	Outside.	62,000	109,080	13.4	41.9	Silky	Mortar No. 20.
4275	Hoop A_6	Outside.	59,000	101,880	16.5	39.2	Fine gr., silky spot	Mortar No. 21.
4271	Hoop B_1	Outside.	58,000	101,440	18.3	47.2	Silky	Mortar No. 21.
4276	Hoop A_4	Outside.	64,000	109,760	15.3	39.2	Silky and gr.....	Mortar No. 22.
4274	Hoop A_4	Outside.	55,000	102,280	19.0	44.6	Silky and fine gr..	Mortar No. 23.
4318	Hoop A_4	Outside.	59,000	105,640	15.5	36.4	Gr., silky center ..	Mortar No. 25.
4343	Hoop A_4	Outside.	58,000	106,360	15.3	33.5	....do	Mortar No. 26.
4345	Hoop A_4	Outside.	59,000	106,200	16.8	33.5	....do	Mortar No. 27.
4344	Hoop A_4	Outside.	60,000	106,360	17.5	41.9	Silky and gr	Mortar No. 28.
4352	Hoop A_4	Outside.	62,000	112,920	16.5	33.5	Gr., silky center ..	Mortar No. 29.
4349	Hoop A_4	Outside.	63,000	108,440	13.3	27.6	Gr., dull spot	Mortar No. 30.

12-INCH B. L. STEEL MORTAR, NO. 1.

SPECIMENS FROM TUBE, JACKET, AND HOOP A_3.

TUBE.

No. 4280.

Marks, $^{12\ S\ M\ R_1\ T}_{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001367	0.	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001500	.000067	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	
13,250	53,000	.001800	.000033	.....	.....	Elastic limit.
13,500	54,000	.010667	.008867	.....	.....	
13,750	55,000	.011333	.000666	.....	.....	
14,000	56,000	.012267	.000934	.....	.....	
14,500	58,000	.013567	.001300	.....	.....	
15,000	60,000	.015667	.002100	.....	.....	
15,500	62,000	.017500	.001833	.....	.....	
16,000	64,000	.019333	.001833	.....	.....	
16,500	66,000	.021667	.002334	.....	.....	
22,890	91,560	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	91,560
Elastic limit per square inch of original section	do	53,000
Elongation per inch after rupture	inch	.2033
Elongation per inch under strain at elastic limit	do	.001800
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per centum of original section		44.6
Position of rupture		1″.65 from the neck
Character of broken surface		silky
Elongation of inch sections		″.11, ″.35,* ″.15

No. 899.

Marks, $\begin{matrix}12\ S\ M\ R_1\ T \\ B\ T_5\ M\end{matrix}$
Length, 5″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 3″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	0.	0.	Initial load.
4,000	5,000	.000133	.000133	.....	.....	
8,000	10,000	.000333	.000200	.....	.....	
12,000	15,000	.000500	.000167	.....	.....	
16,000	20,000	.000667	.000167	0.	.....	
20,000	25,000	.000867	.000200	.....	.....	
24,000	30,000	.001000	.000133	.....	.....	
28,000	35,000	.001167	.000167	.....	.....	
32,000	40,000	.001333	.000166	0.	.....	
36,000	45,000	.001500	.000167	.....	.....	
36,800	46,000	.001567	.000067	.....	.....	
37,600	47,000	.001600	.000033	.....	.....	
38,400	48,000	.001600	0.	.....	.....	
39,200	49,000	.001600	0.	.....	.....	Elastic limit. Micrometer on convex side of specimen.
40,000	50,000	.001567	—.000033	.....	.....	
40,800	51.000	.004900	+.003333	.....	.....	
41,600	52,000	.008067	.003167	.....	.....	
42,400	53,000	.009267	.001200	.....	.....	
43,200	54,000	.009667	.000400	.....	.....	
44,000	55,000	.010567	.000900	.....	.....	
78,640	98,300	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4279.

Marks, $\begin{matrix}12\,S\,M\,R_1\,T\\M\,T_3\,M\end{matrix}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000567	.000300	.....	.....	
7,500	30,000	.000933	.000366	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001267	.000167	0.	.....	
10,250	41,000	.001300	.000033	.....	.....	
10,500	42,000	.001333	.000033	.....	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001567	.000034	.....	.....	
12,500	50,000	.001600	.000033	.....	.....	
12,750	51,000	.001633	.000033	.....	.....	
13,000	52,000	.001700	.000067	.....	.....	
13,250	53,000	.001733	.000033	.....	.....	Elastic limit.
13,500	54,000	.003033	.001300	.....	.....	
13,750	55,000	.010600	.007567	.....	.....	
14,000	56,000	.011567	.000967	.....	.....	
14,500	58,000	.013233	.001666	.....	.....	
15,000	60,000	.015033	.001800	.....	.....	
15,500	62,000	.016500	.001467	.....	.....	
16,000	64,000	.018333	.001833	.....	.....	
16,500	66,000	.020667	.002334	.....	.....	
23,210	92,840	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,840
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.1867
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.05 from the neck
Character of broken surface		silky
Elongation of inch sections		″.27*, ″.17 ″.12

JACKET.

No. 4291.

Marks, $\begin{matrix}12\ S\ M\ R_1\ J\\ B\ T_4\ O\end{matrix}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001267	.000167	.....	.....	
10,500	42,000	.001333	.000066	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001367	0.	.....	.....	
11,250	45,000	.001400	.000033	.....	.....	
11,500	46,000	.001433	.000033	.....	.....	
11,750	47,000	.001467	.000034	.....	.....	
12,000	48,000	.001500	.000033	.....	.....	
12,250	49,000	.001567	.000067	.....	.....	
12,500	50,000	.001600	.000033	.....	.....	
12,750	51,000	.001633	.000033	.....	.....	
13,000	52,000	.001667	.000034	.....	.....	
13,250	53,000	.001667	0.	.....	.....	
13,500	54,000	.001700	.000033	.....	.....	Elastic limit.
13,750	55,000	.009500	.007800	.....	.....	
14,000	56,000	.010267	.000767	.....	.....	
14,250	57,000	.010667	.000400	.....	.....	
14,500	58,000	.011733	.001066	.....	.....	
14,750	59,000	.012933	.001200	.....	.....	
23,510	94,040	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	94,040
Elastic limit per square inch of original section	do	54,000
Elongation per inch after rupture	inch	.2000
Elongation per inch under strain at elastic limit	do	.001700
Reduction in diameter at point of rupture	do	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.23 from the neck
Character of broken surface		silky
Elongation of inch sections		″.23*, ″.27*, ″.10

No. 900.

Marks, $\frac{12\ S\ M\ R_1\ J}{B\ T_5\ M}$
Length, 5″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 3″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	0.	0.	Initial load.
4,000	5,000	.000067	.000067	.....	.....	
8,000	10,000	.000200	.000133	.....	.....	
12,000	15,000	.000367	.000167	.....	.....	
16,000	20,000	.000533	.000166	0.	.....	
20,000	25,000	.000667	.000134	.....	.....	
24,000	30,000	.000833	.000166	.....	.....	
28,000	35,000	.000967	.000134	.....	.....	
32,000	40,000	.001133	.000166	0.	.....	
36,000	45,000	.001267	.000134	.....	.....	
36,800	46,000	.001300	.000033	.....	.....	
37,600	47,000	.001333	.000033	.....	.....	
38,400	48,000	.001400	.000067	.....	.....	Elastic limit.
39,200	49,000	.012500	.011100	.....	.....	
40,000	50,000	.012833	.000333	.....	.....	
40,800	51,000	.013267	.000434	.....	.....	
41,600	52,000	.013833	.000566	.....	.....	
42,400	53,000	.014700	.000867	.....	.....	
43,200	54,000	.015333	.000633	.....	.....	
44,000	55,000	.016200	.000867	.....	.....	
75,180	93,975	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4290.

Marks, $\begin{matrix} 12\ S\ M\ R_1\ J \\ M\ T_3\ M \end{matrix}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001333	.000133	.....	.....	
10,500	42,000	.001467	.000134	0.	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001567	.000067	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	Elastic limit.
12,250	49,000	.001867	.000167	.....	.....	
12,500	50,000	.002600	.000733	.....	.....	
12,750	51,000	.004167	.001567	.....	.....	
13,000	52,000	.005333	.001166	.....	.....	
13,250	53,000	.006167	.000834	.....	.....	
24,430	97,720	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	97,720
Elastic limit per square inch of original section	do	48,000
Elongation per inch after rupture	inch	.1600
Elongation per inch under strain at elastic limit	do	.001700
Reduction in diameter at point of rupture	do	.094
Reduction in area after rupture, per cent of original section		30.6
Position of rupture		″.80 from the neck
Character of broken surface		granular 70 per cent, silky 30 per cent
Elongation of inch sections		″.24*, ″.13 ″.11

12-INCH B. L. STEEL MORTAR No. 1.

Specific Gravity and Hardness of Specimens.

[No tension tests of these specimens.]

Part of mortar.	Marks.	Specific gravity.	Hardness.
Tube	12 S M R_1 T B R_6 I	7.8584	17.53
Jacket....	12 S M R_1 J B R_6 M	7.8545	16.56
Hoop A_3..	12 S M R_1 A_3 B R_4 M	7.8504	20.14

TABULATION OF TENSION SPECIMENS FROM 12-INCH B. L. STEEL MORTAR No. 1.

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.
			Pounds.	*Pounds.*	*Per ct.*	*Per cent.*	
4280	Tube ...	Middle ...	53,000	91,560	20.3	44.6	Silky.
4279	....do ...	....do	53,000	92,840	18.7	41.9	Do.
4291	Jacket..	Outside...	54,000	94,040	20.0	47.2	Do.
4290	....do ...	Middle ...	48,000	97,720	16.0	30.6	Granular, 70 per cent; Silky, 30 per cent.

TABULATION OF COMPRESSION SPECIMENS FROM 12-INCH B. L. STEEL MORTAR No. 1.

No. of test.	Position of gun.	Location of specimens.	Elastic limit per square inch.	Ultimate strength per square inch.	Manner of failure.
			Pounds.	*Pounds.*	
899	Tube	Middle	49,000	98,300	Triple flexure.
900	Jacket.....	....do	48,000	93,975	Do.

SQUARE AND ROUND STEEL WIRE.

.15 SQUARE TINNED STEEL WIRE FROM R. H. WOLFF & CO., LIMITED.

DESCRIPTION OF WIRE.

Coil.	Marks on coil.	Dimensions of wire.		Weight of coil.		Curvature of wire.	
		Inside end.	Outside end.			In coil.	When released.
		Inch.	*Inch.*	*Lbs.*	*Oz.*	*Inches.*	*Inches.*
1	A No. 1	.1491 × .1489	.1503 × .1494	44	0	21	29
2	A No. 2	.1488 × .1489	.1488 × .1486	51	8	21	35
3	Stock 71, strength 3220	.1485 × .1493	.1484 × .1486	55	0	21	44
4	Stock 71, strength 3755	.1486 × .1488	.1485 × .1487	56	0	21	33

The tinning was generally uniformly distributed over the surface of the wire, small naked places being of rare occurence.

In occasional places the tinning was ″.002± in thickness, measuring the wire before and after the excess of tin had been scraped off.

The corners of the third coil were rounded each ″.02±.

A sample of each coil was wrapped around an arbor equal in diameter to the diagonal of the wire, without fracture.

Specimens from First Coil.

No. 4660.

Sectional area, ″.1488 × ″.1492 = .0222 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
111	5,000	0.	0.	Initial load.
444	20,000	.00053	.00053	
888	40,000	.00131	.00078	
1,332	60,000	.00205	.00074	
1,776	80,000	.00293	.00088	
2,220	100,000	.00383	.00090	
2,331	105,000	.00403	.00020	
2,442	110,000	.00426	.00023	
2,553	115,000	.00453	.00027	
2,664	120,000	.00483	.00030	
2,775	125,000	.00510	.00027	
2,886	130,000	.00540	.00030	
2,997	135,000	.00573	.00033	
3,108	140,000	.00605	.00032	
3,219	145,000	.00645	.00040	Elastic limit.
3,330	150,000	.00693	.00048	
3,441	155,000	.00751	.00058	
3,552	160,000	.00821	.00070	
3,663	165,000	.00921	.00100	
3,774	170,000	.01062	.00141	
3,885	175,000	.01320	.00258	
3,996	180,000	.020	.00680	
4,063	183,020	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	183,020
Elastic limit per square inch of original section	do	145,000
Elongation per inch after rupture	inch	.011
Elongation per inch under strain at elastic limit	do	.00645
Reduction in area after rupture, per cent of original section		22.5
Position of rupture		5″.5 outside the gauged length
Character of broken surface		fine, silky

No. 4661.

Sectional area, ″.1493×″.1492=.0223 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
112	5,000	0.	0.	Initial load.
446	20,000	.00062	.00062	
892	40,000	.00168	.00106	
1,338	60,000	.00237	.00069	
1,784	80,000	.00354	.00117	
2,230	100,000	.00442	.00088	
2,676	120,000	.00586	.00144	Elastic limit.
2,788	125,000	.00632	.00046	
2,899	130,000	.00686	.00054	
3,011	135,000	.00741	.00055	
3,122	140,000	.00817	.00076	
3,234	145,000	.00918	.00101	
3,345	150,000	.01026	.00108	
3,457	155,000	.0201	.00175	
3,568	160,000	.016	.00399	
3,680	165,000	.020	.004	
3,764	168,790	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	168,790
Elastic limit per square inch of original section	do...	120,000
Elongation per inch after rupture	inch..	.024
Elongation per inch under strain at elastic limit	do...	.00586
Reduction in area after rupture, per cent of original section		27.8
Position of rupture		1″.8 inside gauged length
Character of broken surface		fine silky

No. 4662.

Sectional area, ″.1493×″.1493=.0223 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
112	5,000	0.	0.	Initial load.
446	20,000	.00069	.00069	
892	40,000	.00148	.00079	
1,338	60,000	.00234	.00086	
1,784	80,000	.00328	.00094	
2,230	100,000	.00440	.00112	
2,342	105,000	.00468	.00028	
2,453	110,000	.00502	.00034	
2,565	115,000	.00538	.00036	
2,676	120,000	.00578	.00040	
2,788	125,000	.00618	.00040	Elastic limit.
2,899	130,000	.00662	.00044	
3,011	135,000	.00719	.00057	
3,122	140,000	.00783	.00064	
3,234	145,000	.00858	.00075	
3,345	150,000	.00961	.00103	
3,457	155,000	.01098	.00137	
3,568	160,000	.014-	.00302	
3,680	165,000	.017	.003	
3,791	170,000	.022	.005	
3,852	172,740	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	172,740
Elastic limit per square inch of original section	do...	125,000
Elongation per inch after rupture	inch..	.024
Elongation per inch under strain at elastic limit	do...	.00618
Reduction in area after rupture, per cent of original section		30
Position of rupture		″.80 inside the gauged length
Character of broken surface		fine silky

Samples from Second Coil.

No. 4663.

Sectional area, .″1488 × .″1488 = .0221 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
111	5,000	0.	0.	Initial load.
442	20,000	.00064	.00064	
884	40,000	.00159	.00095	
1,326	60,000	.00234	.00075	
1,768	80,000	.00323	.00089	
2,210	100,000	.00423	.00100	
2,321	105,000	.00454	.00031	
2,431	110,000	.00484	.00030	
2,542	115,000	.00510	.00026	
2,652	120,000	.00544	.00034	
2,763	125,000	.00577	.00033	
2,873	130,000	.00613	.00036	
2,984	135,000	.00654	.00041	Elastic limit.
3,094	140,000	.00700	.00046	
3,205	145,000	.00757	.00057	
3,315	150,000	.00814	.00057	
3,426	155,000	.00880	.00066	
3,536	160,000	.00956	.00076	
3,647	165,000	.01070	.00114	
3,757	170,000	.012	.00130	
3,868	175,000	.014	.002	
3,978	180,000	.016	.002	
4,058	183,620	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	183,620
Elastic limit per square inch of original section	do...	135,000
Elongation per inch after rupture	inch..	.008
Elongation per inch under strain at elastic limit	do...	.00654
Reduction in area after rupture, per cent of original section		23.5
Position of rupture		4″.5 outside the gauged length
Character of broken surface		fine silky

No. 4664.

Sectional area, ″.1487×″.1488=.0221 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
111	5,000	0.	0.	Initial load.
442	20,000	.00064	.00064	
884	40,000	.00141	.00077	
1,326	60,000	.00221	.00080	
1,768	80,000	.00320	.00099	
2,210	100,000	.00418	.00098	
2,321	105,000	.00448	.00030	
2,431	110,000	.00478	.00030	
2,542	115,000	.00512	.00034	
2,652	120,000	.00543	.00031	
2,763	125,000	.00583	.00040	
2,873	130,000	.00623	.00040	
2,984	135,000	.00661	.00038	Elastic limit.
3,094	140,000	.00717	.00056	
3,205	145,000	.00772	.00055	
3,315	150,000	.00828	.00056	
3,426	155,000	.00913	.00085	
3,536	160,000	.01013	.00100	
3,647	165,000	.01128	.00115	
3,757	170,000	.01281	.00153	
3,868	175,000	.01547	.00266	
3,978	180,000	.020	.00453	
4,048	183,170	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	183,170
Elastic limit per square inch of original section	do...	135,000
Elongation per inch after rupture	inch..	.020
Elongation per inch under strain at elastic limit	do...	.00661
Reduction in area after rupture, per cent of original section		23.5
Position of rupture		2″.30 inside the gauged length
Character of broken surface		fine silky.

No. 4665.

Sectional area, ″.1484×″.1486=.022 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
110	5,000	0.	0.	Initial load.
440	20,000	.00055	.00055	
880	40,000	.00132	.00077	
1,320	60,000	.00212	.00080	
1,760	80,000	.00294	.00082	
2,200	100,000	.00382	.00088	
2,310	105,000	.00402	.00020	
2,420	110,000	.00430	.00028	
2,530	115,000	.00457	.00027	
2,640	120,000	.00478	.00021	
2,750	125,000	.00505	.00027	
2,860	130,000	.00532	.00027	
2,970	135,000	.00558	.00026	
3,080	140,000	.00593	.00035	
3,190	145,000	.00626	.00033	
3,300	150,000	.00662	.00036	Elastic limit.
3,410	155,000	.00706	.00044	
3,520	160,000	.00752	.00046	
3,630	165,000	.00815	.00063	
3,740	170,000	.00895	.00080	
3,850	175,000	.01017	.00122	
3,960	180,000	.012	.00183	
4,070	185,000	.015	.003	
4,180	190,000	.020	.005	
4,217	191,680	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	191,630
Elastic limit per square inch of original section	do...	150,000
Elongation per inch after rupture	inch..	.012
Elongation per inch under strain at elastic limit	do...	.00662
Reduction in area after rupture, per cent of original section		25.5
Position of rupture		7″.6 outside the gauged length
Character of broken surface		fine silky

Specimens from Third Coil.

No. 4666.

Sectional area, ″.1483×″.1486=.022 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
110	5,000	0.	0.	Initial load.
440	20,000	.00063	.00063	
880	40,000	.00140	.00077	
1,320	60,000	.00230	.00090	
1,760	80,000	.00310	.00080	
2,200	100,000	.00410	.00100	
2,310	105,000	.00442	.00032	
2,420	110,000	.00469	.00027	
2,530	115,000	.00502	.00033	
2,640	120,000	.00539	.00037	
2,750	125,000	.00575	.00036	Elastic limit.
2,860	130,000	.00631	.00056	
2,970	135,000	.00694	.00063	
3,080	140,000	.00784	.00090	
3,190	145,000	.00898	.00114	
3,300	150,000	.01120	.00222	
3,386	153,910	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	153,910
Elastic limit per square inch of original section	do	125,000
Elongation per inch after rupture	inch	.024
Elongation per inch under strain at elastic limit	do	.00575
Reduction in area after rupture, per cent of original section		45.0
Position of rupture		4.″1 inside the gauged section
Character of broken surface		fine silky

No. 4667.

Sectional area, ″.1488×″.1483=.022 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
110	5,000	0.	0.	Initial load.
440	20,000	.00056	.00056	
880	40,000	.00137	.00081	
1,320	60,000	.00219	.00082	
1,760	80,000	.00311	.00092	
2,200	100,000	.00421	.00110	
2,310	105,000	.00451	.00030	
2,420	110,000	.00482	.00031	
2,530	115,000	.00516	.00034	
2,640	120,000	.00553	.00037	Elastic limit.
2,750	125,000	.00600	.00047	
2,860	130,000	.00661	.00061	
2,970	135,000	.00731	.00070	
3,080	140,000	.00830	.00099	
3,190	145,000	.00991	.00161	
3,300	150,000	.014	.00409	
3,324	151,090	.....	.....	Tensile strength.

General summary

Tensile strength per square inch of original section	pounds	151,090
Elastic limit per square inch of original section	do	120,000
Elongation per inch after rupture	inch	.008
Elongation per inch under strain at elastic limit	do	.00553
Reduction in area after rupture, per cent of original section		44.1
Position of rupture		4″.9 outside the gauged section
Character of broken surface		fine silky

No. 4668.

Sectional area, ″.1487×″.1484=.022 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
110	5,000	0.	0.	Initial load.
440	20,000	.00058	.00058	
880	40,000	.00138	.00080	
1,320	60,000	.00223	.00085	
1,760	80,000	.00320	.00097	
2,200	100,000	.00430	.00110	
2,310	105,000	.00467	.00037	
2,420	110,000	.00490	.00023	
2,530	115,000	.00528	.00038	
2,640	120,000	.00570	.00042	Elastic limit.
2,750	125,000	.00620	.00050	
2,860	130,000	.00680	.00060	
2,970	135,000	.00762	.00082	
3,080	140,000	.00860	.00098	
3,190	145,000	.01081	.00221	
3,300	150,000	.015	.00419	
3,358	152,640	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	152.640
Elastic limit per square inch of original section	do...	120,000
Elongation per inch after rupture	inch..	.023
Elongation per inch under strain at elastic limit	do...	.00570
Reduction in area after rupture, per cent of original section		40.0
Position of rupture		3″.4 inside the ganged length
Character of broken surface		fine silky

Specimens from Fourth Coil.

No. 4669.

Sectional area, ″.1485×″.1487=.022 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
110	5,000	0.	0.	Initial load.
440	20,000	.00059	.00059	
880	40,000	.00139	.00080	
1,320	60,000	.00222	.00083	
1,760	80,000	.00316	.00094	
2,200	100,000	.00420	.00104	
2,640	120,000	.00531	.00111	
2,750	125,000	.00563	.00032	
2,860	130,000	.00608	.00045	
2,970	135,000	.00648	.00040	Elastic limit.
3,080	140,000	.00698	.00050	
3,190	145,000	.00761	.00063	
3,300	150,000	.00838	.00077	
3,410	155,000	.00942	.00104	
3,520	160,000	.01105	.00163	
3,630	165,000	.014	.00295	
3,704	168,360	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	168,360
Elastic limit per square inch of original section	do...	135,000
Elongation per inch after rupture	inch..	.010
Elongation per inch under strain at elastic limit	do...	.00648
Reduction in area after rupture, per cent of original section		30
Position of rupture		7″ outside the gauged length
Character of broken surface		fine silky

No. 4670.

Sectional area, ″.1484×″.1485=″.022 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
110	5,000	0.	0.	Initial load.
440	20,000	.00065	.00065	
880	40,000	.00150	.00085	
1,320	60,000	.00238	.00088	
1,760	80,000	.00318	.00080	
2,200	100,000	.00413	.00095	
2,640	120,000	.00515	.00102	
2,750	125,000	.00542	.00027	
2,860	130,000	.00573	.00031	
2,970	135,000	.00610	.00037	
3,080	140,000	.00651	.00041	Elastic limit.
3,190	145,000	.00701	.00050	
3,300	150,000	.00757	.00056	
3,410	155,000	.00833	.00076	
3,520	160,000	.00961	.00128	
3,630	165,000	.01200	.00239	
3,708	168,550	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	168,550
Elastic limit per square inch of original section	do...	140,000
Elongation per inch after rupture	inch..	.007
Elongation per inch under strain at elastic limit	do...	.00651
Reduction in area after rupture, per cent of original section		34.5
Position of rupture		9″ outside the gauged length
Character of broken surface		fine silky

No. 4671.

Sectional area, ″.1484×″.1485=.022 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
110	5,000	0.	0.	Initial load.
440	20,000	.00068	.00068	
880	40,000	.00148	.00080	
1,320	60,000	.00229	.00081	
1,760	80,000	.00323	.00094	
2,200	100,000	.00438	.00115	
2,640	120,000	.00578	.00140	
2,750	125,000	.00620	.00042	Elastic limit.
2,860	130,000	.00669	.00049	
2,970	135,000	.00722	.00053	
3,080	140,000	.00790	.00068	
3,190	145,000	.00878	.00088	
3,300	150,000	.00978	.00100	
3,410	155,000	.01154	.00176	
3,520	160,000	.016	.00446	
3,597	163,500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	163,500
Elastic limit per square inch of original section	do	125,000
Elongation per inch after rupture	inch	.022
Elongation per inch under strain at elastic limit	do	.00620
Reduction in area after rupture, per cent of original section		27.7
Position of rupture		4″.2 inside the gauged section
Character of broken surface		fine silky

TABULATION OF TENSION TESTS ".15 SQUARE TINNED STEEL WIRE.

From R. H. Wolff & Co. Limited.

No. of test.	Mark on coil.	Dimensions in inches.		Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 10 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.
		Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.	Inch.	Per cent.			
				Sq. inch.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*Inch. Sq. In.*	*Per cent.*	
4660	1	.1488	.1492	.0222	3,219	145,000	4,063	183,020	.11	1.1	.131×.131=.0172	22.5	Fine silky.
4661	1	.1493	.1492	.0223	2,676	120,000	3,764	168,790	.24	2.4	.127×.127=.0161	27.8	Do.
4662	1	.1493	.1493	.0223	2,788	125,000	3,852	172,740	.24	2.4	.125×.125=.0156	30.0	Do.
4663	2	.1488	.1488	.0221	2,984	135,000	4.058	183,620	.08	0.8	.130×.130=.0169	23.5	Do.
4664	2	.1487	.1488	.0221	2,984	135,000	4,048	183,170	.20	2.0	.130×.130=.0169	23.5	Do.
4665	2	.1484	.1486	.0220	3,300	150,000	4,217	191,680	.12	1.2	.128×.128=.0164	25.5	Do.
4666	3	.1483	.1486	.0220	2,750	125,000	3,386	153,910	.24	2.4	.110×.110=.0121	45.0	Do.
4667	3	.1488	.1483	.0220	2,640	120,000	3,324	151,090	.08	0.8	.111×.111=.0123	44.1	Do.
4668	3	.1487	.1484	.0220	2,640	120,000	3,358	152,640	.23	2.3	.115×.115=.0132	40.0	Do.
4669	4	.1485	.1487	.0220	2,970	135,000	3,704	168,360	.10	1.0	.124×.124=.0154	30.0	Do.
4670	4	.1484	.1485	.0220	3,080	140,000	3,708	168,550	.07	0.7	.120×.120=.0144	34.5	Do.
4671	4	.1484	.1485	.0220	2,750	125,000	3,597	163,500	.22	2.2	.126×.126=.0159	27.7	Do.

".15 SQUARE STEEL, TINNED, WIRE WITH SERRATED SCARF JOINTS.

[Brazed joints.]

FIRST LOT.

No. of test.	Marks.	Tensile strength.	Fractured.
		Pounds.	
5289	1	2564	¼″ from end of scarf.
5290	2	1680	Along the scarf.
5291	3	1767	Do.
5292	4	1240	Do.
5293	5	1798	¼″ from end of scarf.
5294	6	1931	Do.
5295	7	1195	Along the scarf.
5296	8	1797	¼″ from end of scarf.
5297	9	1484	Along the scarf.
5298	10	1710	Do.

SECOND LOT.

5325	1	2336	¼″ from end of scarf.
5326	2	2366	Do.
5327	3	2297	At end of scarf.
5328	4	2270	½″ from end of scarf.
5329	5	2437	Do.
5330	6	2468	¼″ from end of scarf.
5331	7	1180	Along the scarf.

THIRD LOT.

5332	1	2270	One-half along scarf and one-half across wire.
5333	2	1845	Along the scarf.
5334	3	2355	¼″ from end of scarf.
5335	4	2410	Do.
5336	5	2382	Do.

FOURTH LOT.

5365	1	2030	¼″ from end of scarf.
5366	2	2020	Do.
5367	3	2214	Followed the scarf.
5368	4	2259	¼″ from end of scarf.
5369	5	2091	Do.

FIFTH LOT.

5372	1	1575	Followed scarf in part, and then across wire.
5373	2	1660	¼″ from end of scarf.
5374	3	1680	Do.
5375	4	1590	Along the scarf.
5376	5	1535	Across middle of joint.
5377	6	1505	Do.

SIXTH LOT.

5393	1	2546	At end of scarf.
5394	2	2490	Do.
5395	3	2515	Do.
5396	4	2440	Do.
5397	5	2294	Across the joint ½″ from end of scarf.
5398	6	2464	At end of scarf.
5399	7	2097	Across the joint ⅜″ from end of scarf.
5400	8	2470	At end of scarf.
5401.	9	2392	Do.
5402	10	2010	Across the joint ⅜″ from end of scarf.
5403	11	2470	At end of heated section.
5404	12	2405	Do.
5405	13	2460	Do.
5406	14	2398	Do.
5407	15	2345	Do.
5408	16	2490	Do.
5409	17	2408	At end of treated section.
5410	18	2430	Do.
5411	19	2440	Do.
5412	20	2395	Do.

Round Wire not Tinned.

No. 4358.

Diameter, ″.253.
Sectional area, .05 square inch.
Gauged length, 10″.

[Specimen received from Lieut. Col. J. P. Farley, New York Arsenal.]

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
250	5,000	0.	0.	Initial load.
500	10,000	.000400	.000400	
750	15,000	.000690	.000290	
1,000	20,000	.000930	.000240	
1,250	25,000	.001200	.000270	
1,500	30,000	.001380	.000180	
1,750	35,000	.001600	.000220	
2,000	40,000	.001860	.000260	
2,250	45,000	.002110	.000250	
2,500	50,000	.002410	.000300	
2,750	55,000	.002730	.000320	Elastic limit.
3,000	60,000	.003180	.000450	
3,250	65,000	.003720	.000540	
3,500	70,000	.004460	.000740	
3,750	75,000	.005500	.001040	
4,000	80,000	.006700	.001200	
4,250	85,000	.008120	.001420	
4,500	90,000	.010050	.001930	
4,750	95,000	.012	.001950	
5,000	100,000	.016	.004	
5,250	105,000	.018	.002	
5,500	110,000	.022	.004	
5,750	115,000	.026	.004	
6,000	120,000	.030	.004	
6,250	125,000	.034	.004	
6,500	130,000	.040	.006	
6,750	135,000	.049	.009	
7,000	140,000	.068	.019	
7,035	140,700	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	140,700
Elastic limit per square inch of original section	do...	55,000
Elongation per inch after rupture	inch..	.061
Elongation per inch under strain at elastic limit	do..	.00273
Reduction in diameter at point of rupture		″.028
Reduction in area after rupture, per cent of original section		.20
Position of rupture		1″.9 outside the gauged length
Character of broken surface		fine granular, dull center

ROUND AND SQUARE STEEL WIRE FROM LIEUT. COL. J. P. FARLEY, NEW YORK ARSENAL.

No. of test.	Surface of wire.	Dimensions.	Sectional area.	Tensile strength.		Elongation in 10 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.
				Total.	Per square inch.	Inch.	Per cent.			
		Inch.	*Sq. inch.*	*Pounds.*	*Pounds.*			*Inch.* *Sq. inch.*	*Per cent.*	
4358	Not tinned	.253 diameter.	.05	7,035	140,700	.61	6.1	Diam. .225=.040	20.0	Fine granular, dull center.
4359	....do	.253 diameter.	.05	7,095	141,900	.60	6.0	Diam. .225=.040	20.0	Do.
4360	Tinned	.1488×.1488	.0221	4,068	184,070	.06	0.6	.123×.123=.0151	31.7	Fine silky.
4361	....do	.1492×.1490	.0222	4,090	184,230	.13	1.3	.120×.120=.0144	35.1	Do.
4362	....do	.1490×.1489	.0222	3,610	162,610	.12	1.2	.119×.119=.0142	36.0	Do.
4363	....do	.1484×.1486	.0221	3,685	166,740	.06	0.6	.118×.118=.0139	37.1	Do.
4364	....do	.1485×.1485	.0221	4,063	183,850	.20	2.0	.127×.127=.0161	27.1	Do.
4365	....do	.1487×.1490	.0222	3,945	177,700	.23	2.3	.120×.120=.0144	35.1	Do.
4366	....do	.1488×.1495	.0222	3,985	179,500	.08	0.8	.125×.125=.0156	29.7	Do.
4367	....do	.1492×.1492	.0223	4,393	197,000	.22	2.2	.125×.125=.0156	30.0	Do.
4368	....do	.1495×.1490	.0223	3,675	164,800	.07	0.7	.121×.127=.0154	30.9	Do.
4369	....do	.1503×.1500	.0225	4,749	211,070	.10	1.0	.135×.135=.0182	19.1	Silky, slightly granular.

ALUMINUM BRONZE.

CASTINGS FOR CONSOLES FOR 12-INCH B. L. RIFLED MORTARS.

Composition, approximately: Al. 5. Zn. 15. Cu. 80.

Casting No. 5.

No. 4287.

Marks, $\frac{5}{1}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 1″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0001	.0001	
2,000	10,000	.0003	.0002	
3,000	15,000	.0008	.0005	
3,200	16,000	.0010	.0002	
3,400	17,000	.0012	.0002	Elastic limit.
3,600	18,000	.0017	.0005	
3,800	19,000	.0022	.0005	
4,000	20,000	.0030	.0008	
4,200	21,000	.0037	.0007	
4,400	22,000	.0042	.0005	
4,600	23,000	.0052	.0010	
4,800	24,000	.0064	.0012	
5,000	25,000	.0078	.0014	
5,200	26,000	.0090	.0012	
5,400	27,000	.0101	.0011	
5,600	28,000	.0120	.0019	
5,800	29,000	.0141	.0021	
6,000	30,000	.0168	.0027	
6,400	32,000	.0231	.0063	
6,800	34,000	.0307	.0076	
7,200	36,000	.0407	.0100	
7,600	38,000	.06	.0193	
8,000	40,000	.07	.01	
8,400	42,000	.09	.02	
8,620	43,100	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	43,100
Elastic limit per square inch of original section	do...	17,000
Elongation per inch after rupture	inch..	″.14
Elongation per inch under strain at elastic limit	do...	.0012
Reduction in diameter at point of rupture	do...	.035
Reduction in area after rupture, per cent of original section		13.2
Character of broken surface		light yellow color

No. 4288.

Marks, $\frac{5}{2}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 1″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0002	.0002	
2,000	10,000	.0007	.0005	
2,800	14,000	.0012	.0005	
3,000	15,000	.0016	.0004	
3,200	16,000	.0018	.0002	Elastic limit, approximate.
3,400	17,000	.0022	.0004	
3,600	18,000	.0028	.0006	
3,800	19,000	.0032	.0004	
4,000	20,000	.0037	.0005	
4,200	21,000	.0043	.0006	
4,400	22,000	.0052	.0009	
4,600	23,000	.0061	.0009	
4,800	24,000	.0073	.0012	
5,000	25,000	.0087	.0014	
5,200	26,000	.0101	.0014	
5,400	27,000	.0112	.0011	
5,600	28,000	.0130	.0018	
5,800	29,000	.0158	.0028	
6,000	30,000	.0181	.0023	
6,400	32,000	.0240	.0059	
6,800	34,000	.0328	.0088	
7,200	36,000	.0410	.0082	
7,600	38,000	.0530	.0120	
8,000	40,000	.0670	.0140	
8,400	42,000	.08	.013	
8,800	44,000	.10	.02	
9,200	46,000	.12	.02	
9,600	48,000	.14	.02	
10,000	50,000	.17	.03	
10,400	52,000	.19	.02	
10,530	52,650	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	52,650
Elastic limit per square inch of original section, approximate	do...	16,000
Elongation per inch after rupture	inch..	.25
Elongation per inch under strain at elastic limit	do...	.0018
Reduction in diameter at point of rupture	do...	.075
Reduction in area after rupture, per cent of original section		27.4
Character of broken surface		light yellow color

No. 4289.

Marks, $\frac{5}{3}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 1″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0003	.0003	
2,000	10,000	.0007	.0004	
3,000	15,000	.0013	.0006	Elastic limit.
3,200	16,000	.0024	.0011	
3,400	17,000	.0030	.0006	
3,600	18,000	.0034	.0004	
3,800	19,000	.0048	.0014	
4,000	20,000	.0064	.0016	
4,200	21,000	.0073	.0009	
4,400	22,000	.0092	.0019	
4,600	23,000	.0117	.0025	
4,800	24,000	.0132	.0015	
5,000	25,000	.0167	.0035	
5,200	26,000	.0188	.0021	
5,400	27,000	.0231	.0043	
5,600	28,000	.0271	.0040	
5,800	29,000	.0313	.0042	
6,000	30,000	.0391	.0078	
6,400	32,000	.0507	.0116	
6,670	33,350	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	33,350
Elastic limit per square inch of original section	do...	15,000
Elongation per inch after rupture	inch..	.10
Elongation per inch under strain at elastic limit	do...	.0013
Reduction in diameter at point of rupture	do...	.035
Reduction in area after rupture, per cent of original section		13.2
Character of broken surface		light yellow color

Casting No. 6.

No. 4283.

Marks, $\frac{6}{1}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 1″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0002	.0002	
2,000	10,000	.0006	.0004	
3,000	15,000	.0010	.0004	Elastic limit.
3,200	16,000	.0013	.0003	
3,400	17,000	.0016	.0003	
3,600	18,000	.0021	.0005	
3,800	19,000	.0026	.0005	
4,000	20,000	.0031	.0005	
4,200	21,000	.0039	.0008	
4,400	22,000	.0047	.0008	
4,600	23,000	.0058	.0011	
4,800	24,000	.0069	.0011	
5,000	25,000	.0084	.0015	
5,200	26,000	.0102	.0018	
5,400	27,000	.0117	.0015	
5,600	28,000	.0145	.0028	
5,800	29,000	.0170	.0025	
6,000	30,000	.0201	.0031	
6,400	32,000	.0277	.0076	
6,800	34,000	.0378	.0101	
7,200	36,000	.0510	.0132	
7,600	38,000	.0630	.0120	
8,000	40,000	.0810	.0180	
8,190	40,950	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	40,950
Elastic limit per square inch of original section	do...	15,000
Elongation per inch after rupture	inch..	.12
Elongation per inch under strain at elastic limit	do...	.0010
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Character of broken surface		Light yellow color

No. 4284.

Marks, $\frac{6}{2}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 1″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0002	.0002	
2,000	10,000	.0006	.0004	
2,200	11,000	.0007	.0001	
2,400	12,000	.0008	.0001	
2,600	13,000	.0009	.0001	Elastic limit.
2,800	14,000	.0012	.0003	
3,000	15,000	.0016	.0004	
3,200	16,000	.0020	.0004	
3,400	17,000	.0024	.0004	
3,600	18,000	.0028	.0004	
3,800	19,000	.0033	.0005	
4,000	20,000	.0040	.0007	
4,200	21,000	.0049	.0009	
4,400	22,000	.0058	.0009	
4,600	23,000	.0072	.0014	
4,800	24,000	.0090	.0018	
5,000	25,000	.0102	.0012	
5,200	26,000	.0125	.0023	
5,400	27,000	.0150	.0025	
5,600	28,000	.0173	.0023	
5,800	29,000	.0200	.0027	
6,000	30,000	.0240	.0040	
6,400	32,000	.0338	.0098	
6,800	34,000	.04	.0062	
7,200	36,000	.05	.01	
7,600	38,000	.07	.02	
8,000	40,000	.09	.02	
8,400	42,000	.11	.02	
8,800	44,000	.135	.025	
9,200	46,000	.16	.025	
9,380	46,900	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	46,900
Elastic limit per square inch of original section	do	13,000
Elongation per inch after rupture	inch	.21
Elongation per inch under strain at elastic limit	do	.0009
Reduction in diameter at point of rupture	do	.055
Reduction in area after rupture, per cent of original section		20.5
Character of broken surface		light yellow color

Casting No. 7.

No. 4285.

Marks, $\frac{7}{1}$
Diameter, $''.505$.
Sectional area, .20 square inch.
Gauged length, $1''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0003	.0003	
2,000	10,000	.0006	.0003	
2,200	11,000	.0007	.0001	
2,400	12,000	.0008	.0001	
2,600	13,000	.0009	.0001	
2,800	14,000	.0009	0.	
3,000	15,000	.0010	.0001	
3,200	16,000	.0011	.0001	Elastic limit.
3,400	17,000	.0015	.0004	
3,600	18,000	.0020	.0005	
3,800	19,000	.0026	.0006	
4,000	20,000	.0036	.0010	
4,200	21,000	.0046	.0010	
4,400	22,000	.0056	.0010	
4,600	23,000	.0068	.0012	
4,800	24,000	.0082	.0014	
5,000	25,000	.0104	.0022	
5,200	26,000	.0120	.0016	
5,400	27,000	.0147	.0027	
5,600	28,000	.0168	.0021	
5,800	29,000	.0191	.0023	
6,000	30,000	.0240	.0049	
6,400	32,000	.0350	.0110	
6,800	34,000	.0400	.0050	
7,200	36,000	.0550	.0150	
7,600	38,000	.0750	.0200	
8,000	40,000	.0900	.0150	
8,400	42,000	.1050	.0150	
8,610	43,050	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	43,050
Elastic limit per square inch of original section	do...	16,000
Elongation per inch after rupture	inch..	.15
Elongation per inch under strain at elastic limit	do...	.0011
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Character of broken surface		light yellow color

No. 4286.

Marks, $\frac{7}{2}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 1″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0002	.0002	
2,000	10,000	.0005	.0003	
2,400	12,000	.0006	.0001	
2,600	13,000	.0008	.0002	
2,800	14,000	.0010	.0002	
3,000	15,000	.0012	.0002	Elastic limit.
3,200	16,000	.0018	.0006	
3,400	17,000	.0021	.0003	
3,600	18,000	.0027	.0006	
3,800	19,000	.0035	.0008	
4,000	20,000	.0050	.0015	
4,200	21,000	.0059	.0009	
4,400	22,000	.0072	.0013	
4,600	23,000	.0086	.0014	
4,800	24,000	.0110	.0024	
5,000	25,000	.0130	.0020	
5,200	26,000	.0141	.0011	
5,400	27,000	.0172	.0031	
5,600	28,000	.0205	.0033	
5,800	29,000	.0240	.0035	
6,000	30,000	.0280	.0040	
6,400	32,000	.0382	.0102	
6,800	34,000	.0520	.0138	
7,200	36,000	.0650	.0130	
7,600	38,000	.08	.0150	
8,000	40,000	.105	.025	
8,400	42,000	.13	.025	
8,800	44,000	.15	.02	
9,200	46,000	.17	.02	
9,510	47,550			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	47,550
Elastic limit per square inch of original section	do...	15,000
Elongation per inch after rupture	inch..	.20
Elongation per inch under strain at elastic limit	do...	.0012
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Character of broken surface		light yellow color

TENSILE TEST OF STEEL AND BRASS RIBBON TAPE

FOR

ENGINEER CORPS, U. S. ARMY.

251

No. 4649.

Steel Tape.

Sectional area ″.128 × ″.0127 = .0016 square inch.
Gauged length, 10″.
Temperature, 76° F.

Applied loads.		Elongation in gauged length.	Remarks.
Total.	Per square inch.		
Pounds.	*Pounds.*	*Inch.*	
5	.....	0.	
10	.....	.0002	Initial load.
20	.....	.0027	
30	.....	.0054	
40	.....	.0079	
50	.....	.0105	
60	.....	.0123	
70	.....	.0144	
80	.....	.0167	
90	.....	.0196	
100	.....	.0220	
110	.....	.0234	
120	.....	.0260	
130	.....	.0283	
140	.....	.0307	
150	.....	.0329	
160	.....	.0343	
170	.....	.0367	
180	.....	.0390	
190	.....	.0411	
200	.....	.0434	Elastic limit above this load.
417	260,625	.....	Tensile strength.

No. 4650.

Brass Tape.

Sectional area, ″.128 × ″.0127 = .0016 square inch.
Gauged length, 10″.
Temperature, 76° F.

Applied loads.		Elongation in gauged length.	Remarks.
Total.	Per square inch.		
Pounds.	*Pounds.*	*Inch.*	
5	.....	0.	Initial load.
10	.....	.0052	
15	.....	.0089	
20	.....	.0110	
25	.....	.0134	
30	.....	.0159	
35	.....	.0172	
40	.....	.0193	
45	.....	.0216	
50	.....	.0236	
55	.....	.0256	
60	.....	.0280	
65	.....	.0300	
70	.....	.0330	
75	.....	.0344	
80	.....	.0380	
85	.....	.0413	
90	.....	.0433	
95	.....	.0466	
100	.....	.0486	
105	.....	.0537	
110	.....	.0566	
115	71,875	.0585	Elastic limit.
120	.....	.0697	
122	.....	.0828	
124	77,500	.1358	Tensile strength.

COMPRESSION OF TEN COPPER CYLINDERS, FOR MEAN PERMANENT SETS, FOR COPPERS IN CRUSHER GAUGE OF ONE-SIXTH SQUARE INCH AREA.

	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*			
Length	.4994	.4996	.4996	.4996	.5000	.4995	.4994	.4994	.4992	.4996			
Diameter	.3240	.3241	.3240	.3240	.3241	.3238	.3240	.3237	.3243	.3238			
Applied loads.		Total compression of coppers.										Corrected sets.	
Total.	Per square inch on crusher gauge.	1	2	3	4	5	6	7	8	9	10	Mean.	Total.	From 18,000 to 60,000 pounds.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
3,000	18,000	.0797	.0830	.0849	.0842	.0723	.0700	.0702	.0702	.0670	.0705	.0752	.0746	
3,083	18,500	.0827	0.860	.0875	.0862	.0743	.0722	.0717	.0733	.0685	.0725	.0775	.0769	.0023
3,167	19,000	.0860	.0898	.0910	.0906	.0768	.0760	.0750	.0757	.0720	.0754	.0808	.0802	.0056
3,250	19,500	.0891	.0925	.0945	.0940	.0803	.0787	.0790	.0792	.0750	.0787	.0841	.0835	.0089
3,333	20,000	.0925	.0960	.0978	.0968	.0845	.0814	.0812	.0828	.0790	.0818	.0874	.0867	.0121
3,417	20,500	.0955	.0990	.1012	.0998	.0872	.0850	.0847	.0852	.0818	.0852	.0905	.0898	.0152
3,500	21,000	.0987	.1020	.1038	.1029	.0896	.0879	.0880	.0881	.0847	.0880	.0934	.0927	.0181
3,583	21,500	.1023	.1055	.1074	.1061	.0937	.0915	.0907	.0912	.0877	.0914	.0967	.0960	.0214
3,667	22,000	.1055	.1085	.1103	.1093	.0960	.0948	.0947	.0950	.0915	.0954	.1001	.0993	.0247
3,750	22,500	.1089	.1123	.1143	.1129	.1007	.0981	.0972	.0982	.0949	.0990	.1036	.1028	.0282
3,833	23,000	.1121	.1154	.1182	.1167	.1029	.1013	.1010	.1017	.0982	.1017	.1069	.1061	.0315
3,917	23,500	.1155	.1186	.1205	.1195	.1058	.1050	.1043	.1048	.1025	.1042	.1101	.1093	.0347
4,000	24,000	.1180	.1218	.1232	.1231	.1098	.1080	.1080	.1074	.1050	.1085	.1133	.1124	.0378
4,083	24,500	.1217	.1252	.1269	.1262	.1135	.1112	.1110	.1109	.1085	.1110	.1166	.1157	.0411
4,167	25,000	.1252	.1282	.1305	.1294	.1165	.1149	.1141	.1146	.1105	.1147	.1199	.1190	.0444
4,250	25,500	.1282	.1312	.1348	.1320	.1197	.1180	.1182	.1181	.1140	.1173	.1232	.1223	.0477
4,333	26,000	.1312	.1352	.1360	.1363	.1228	.1200	.1202	.1204	.1185	.1206	.1261	.1251	.0505
4,417	26,500	.1346	.1379	.1397	.1387	.1269	.1252	.1242	.1244	.1205	.1245	.1297	.1287	.0541
4,500	27,000	.1373	.1413	.1425	.1418	.1290	.1275	.1267	.1275	.1242	.1275	.1325	.1315	.0569
4,583	27,500	.1407	.1448	.1459	.1460	.1321	.1312	.1302	.1308	.1270	.1312	.1360	.1350	.0604
4,667	28,000	.1443	.1485	.1498	.1477	.1360	.1330	.1333	.1342	.1302	.1340	.1391	.1380	.0634
4,750	28,500	.1473	.1503	.1530	.1512	.1390	.1372	.1368	.1380	.1345	.1370	.1424	.1413	.0667
4,833	29,000	.1507	.1535	.1552	.1543	.1428	.1402	.1399	.1410	.1376	.1407	.1456	.1445	.0699
4,917	29,500	.1536	.1567	.1580	.1575	.1453	.1440	.1427	.1427	.1399	.1437	.1484	.1473	.0727
5,000	30,000	.1567	.1600	.1612	.1602	.1474	.1470	.1477	.1472	.1430	.1467	.1517	.1505	.0759
5,083	30,500	.1600	.1627	.1641	.1622	.1511	.1500	.1495	.1495	.1463	.1493	.1545	.1533	.0787
5,167	31,000	.1628	.1655	.1673	.1664	.1547	.1530	.1520	.1530	.1496	.1538	.1578	.1566	.0820
5,250	31,500	.1659	.1688	.1705	.1693	.1575	.1580	.1547	.1560	.1531	.1565	.1610	.1598	.0852
5,333	32,000	.1687	.1715	.1735	.1725	.1610	.1595	.1583	.1590	.1563	.1593	.1640	.1627	.0881
5,417	32,500	.1717	.1750	.1762	.1757	.1648	.1623	.1617	.1620	.1585	.1628	.1671	.1658	.0912
5,500	33,000	.1746	.1776	.1787	.1785	.1678	.1648	.1643	.1652	.1612	.1651	.1698	.1685	.0939
5,583	33,500	.1779	.1802	.1823	.1809	.1700	.1691	.1674	.1686	.1647	.1697	.1731	.1718	.0972
5,667	34,000	.1803	.1835	.1848	.1832	.1727	.1713	.1715	.1710	.1680	.1710	.1757	.1743	.0997
5,750	34,500	.1833	.1862	.1880	.1862	.1757	.1740	.1739	.1741	.1778	.1744	.1787	.1773	.1027

COMPRESSION OF TEN COPPER CYLINDERS FOR MEAN PERMANENT SETS, ETC.—Continued.

Applied loads.		Total compression of coppers.											Corrected sets.	
Total.	Per square inch on crusher gauge.	1	2	3	4	5	6	7	8	9	10	Mean.	Total.	From 18,000 to 60,000 pounds.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
5,833	35,000	.1862	.1890	.1902	.1890	.1797	.1773	.1764	.1770	.1741	.1778	.1817	.1803	.1057
5,917	35,500	.1890	.1920	.1915	.1925	.1817	.1802	.1795	.1795	.1768	.1802	.1843	.1829	.1083
6,000	36,000	.1918	.1945	.1966	.1950	.1841	.1822	.1820	.1830	.1795	.1835	.1872	.1856	.1110
6,083	36,500	.1948	.1973	.1982	.1978	.1872	.1855	.1847	.1850	.1825	.1867	.1900	.1884	.1138
6,167	37,000	.1979	.2005	.2012	.2009	.1902	.1880	.1883	.1875	.1857	.1895	.1930	.1914	.1168
6,250	37,500	.2010	.2032	.2042	.2038	.1928	.1905	.1912	.1906	.1885	.1916	.1957	.1941	.1195
6,333	38,000	.2036	.2059	.2061	.2065	.1953	.1933	.1940	.1936	.1916	.1939	.1984	.1968	.1222
6,417	38,500	.2062	.2085	.2086	.2087	.1983	.1960	.1962	.1962	.1937	.1960	.2008	.1992	.1246
6,500	39,000	.2089	.2100	.2117	.2115	.2012	.1985	.1987	.1985	.1960	.1980	.2033	.2017	.1271
6,583	39,500	.2113	.2130	.2138	.2135	.2030	.2023	.2012	.2028	.1985	.2000	.2059	.2043	.1297
6,667	40,000	.2138	.2160	.2160	.2157	.2056	.2050	.2040	.2057	.2020	.2030	.2087	.2069	.1323
6,750	40,500	.2163	.2185	.2188	.2188	.2087	.2073	.2072	.2075	.2050	.2055	.2114	.2096	.1350
6,833	41,000	.2186	.2200	.2206	.2207	.2107	.2098	.2098	.2102	.2069	.2090	.2136	.2118	.1372
6,917	41,500	.2209	.2230	.2228	.2220	.2133	.2121	.2115	.2125	.2100	.2115	.2160	.2142	.1396
7,000	42,000	.2235	.2244	.2258	.2248	.2162	.2145	.2141	.2150	.2121	.2132	.2184	.2166	.1420
7,083	42,500	.2257	.2272	.2280	.2274	.2179	.2169	.2168	.2175	.2144	.2150	.2207	.2189	.1443
7,167	43,000	.2279	.2295	.2300	.2298	.2205	.2197	.2191	.2197	.2170	.2182	.2231	.2213	.1467
7,250	43,500	.2299	.2315	.2325	.2320	.2228	.2216	.2213	.2217	.2188	.2205	.2253	.2235	.1489
7,333	44,000	.2320	.2340	.2345	.2345	.2250	.2237	.2235	.2243	.2215	.2228	.2276	.2258	.1512
7,417	44,500	.2343	.2362	.2371	.2365	.2273	.2265	.2258	.2262	.2236	.2258	.2299	.2281	.1535
7,500	45,000	.2363	.2380	.2387	.2382	.2296	.2281	.2282	.2285	.2257	.2271	.2318	.2300	.1554
7,583	45,500	.2388	.2399	.2405	.2407	.2320	.2303	.2305	.2307	.2280	.2293	.2341	.2323	.1577
7,667	46,000	.2407	.2420	.2430	.2427	.2343	.2333	.2329	.2330	.2303	.2315	.2364	.2346	.1600
7,750	46,500	.2447	.2443	.2453	.2446	.2365	.2350	.2348	.2345	.2325	.2345	.2385	.2367	.1621
7,833	47,000	.2427	.2463	.2470	.2469	.2386	.2373	.2373	.2373	.2346	.2362	.2406	.2388	.1642
7,917	47,500	.2469	.2479	.2490	.2386	.2407	.2393	.2393	.2398	.2372	.2380	.2427	.2409	.1663
8,000	48,000	.2490	.2499	.2508	.2504	.2425	.2410	.2431	.2417	.2389	.2402	.2447	.2429	.1683
8,083	48,500	.2506	.2520	.2530	.2525	.2443	.2430	.2443	.2436	.2410	.2422	.2467	.2449	.1703
8,167	49,000	.2525	.2542	.2542	.2548	.2467	.2450	.2460	.2452	.2425	.2450	.2486	.2468	.1722
8,250	49,500	.2545	.2558	.2563	.2560	.2481	.2470	.2472	.2474	.2445	.2471	.2504	.2486	.1740
8,333	50,000	.2565	.2577	.2580	.2575	.2505	.2487	.2488	.2497	.2467	.2490	.2523	.2503	.1757
8,417	50,500	.2580	.2593	.2597	.2597	.2522	.2505	.2508	.2510	.2485	.2498	.2540	.2520	.1774
8,500	51,000	.2595	.2610	.2617	.2615	.2543	.2524	.2525	.2530	.2500	.2515	.2557	.2537	.1791
8,583	51,500	.2618	.2529	.2637	.2632	.2558	.2542	.2550	.2548	.2520	.2535	.2577	.2557	.1811
8,667	52,000	.2636	.2645	.2653	.2648	.2575	.2562	.2590	.2567	.2541	.2555	.2594	.2574	.1828
8,750	52,500	.2647	.2663	.2667	.2663	.2595	.2578	.2570	.2583	.2560	.2574	.2610	.2590	.1844
8,833	53,000	.2665	.2679	.2684	.2680	.2613	.2595	.2597	.2606	.2582	.2595	.2630	.2610	.1864
8,917	53,500	.2683	.2696	.2700	.2695	.2633	.2615	.2610	.2620	.2597	.2602	.2645	.2625	.1879
9,000	54,000	.2699	.2717	.2714	.2715	.2647	.2630	.2660	.2640	.2610	.2620	.2662	.2642	.1896

9,083	54,500	.2715	.2731	.2735	.2733	.2665	.2650	.2647	.2636	.2625	.2632	.2679	.2659	.1913
9,167	55,000	.2731	.2749	.2751	.2748	.2680	.2667	.2665	.2670	.2647	.2647	.2695	.2675	.1929
9,250	55,500	.2747	.2764	.2762	.2760	.2698	.2681	.2674	.2689	.2662	.2666	.2710	.2690	.1944
9,333	56,000	.2762	.2780	.2779	.2774	.2713	.2696	.2695	.2705	.2689	.2690	.2728	.2708	.1962
9,417	56,500	.2777	.2794	.2795	.2792	.2733	.2724	.2708	.2717	.2694	.2707	.2844	.2724	.1978
9,500	57,000	.2792	.2805	.2815	.2809	.2746	.2742	.2725	.2737	.2703	.2731	.2760	.2740	.1994
9,583	57,500	.2807	.2822	.2824	.2820	.2757	.2752	.2740	.2750	.2722	.2743	.2774	.2754	.2008
9,667	58,000	.2825	.2837	.2833	.2840	.2773	.2762	.2752	.2763	.2738	.2752	.2788	.2768	.2022
9,750	58,500	.2839	.2849	.2848	.2850	.2790	.2773	.2767	.2775	.2752	.2770	.2801	.2781	.2035
9,833	59,000	.2852	.2863	.2865	.2860	.2805	.2790	.2780	.2792	.2767	.2782	.2816	.2796	.2050
9,917	59,500	.2868	.2876	.2880	.2879	.2820	.2808	.2800	.2808	.2778	.2797	.2831	.2811	.2065
10,000	60,000	.2880	.2889	.2892	.2893	.2835	.2820	.2812	.2820	.2794	.2810	.2845	.2825	.2079

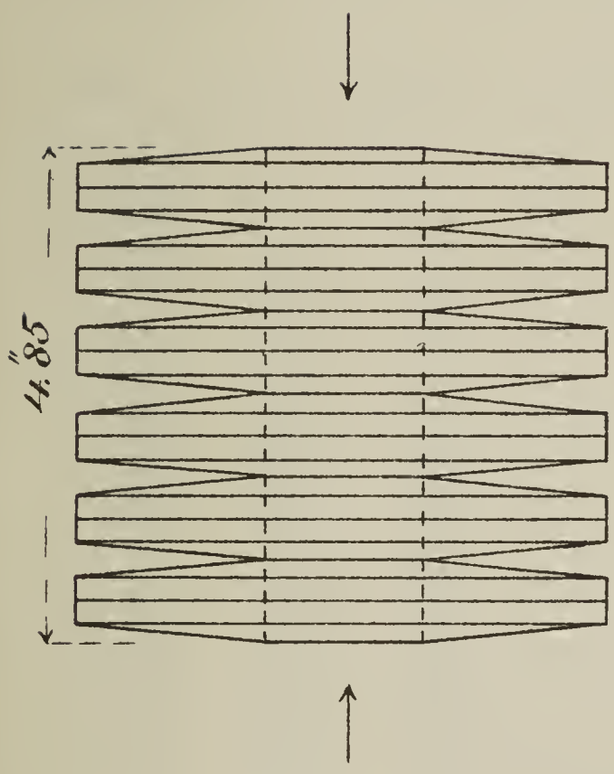
No. 5165.

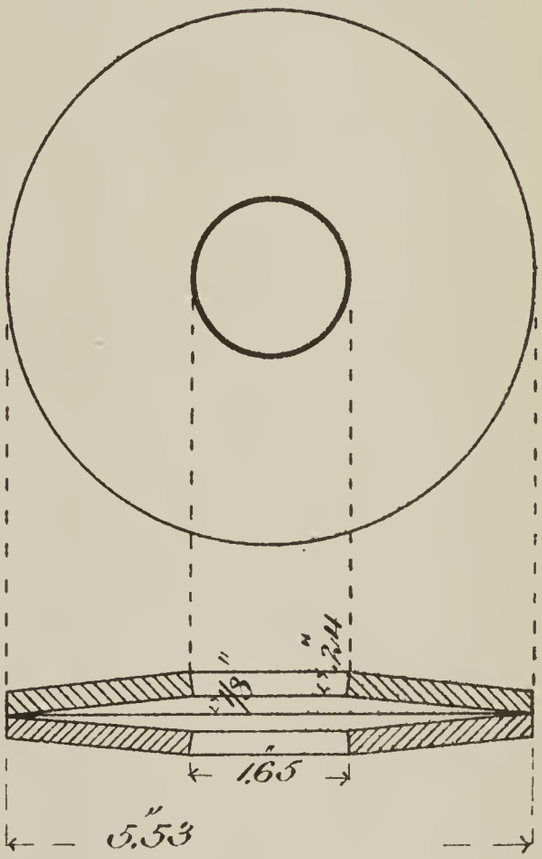
Six pairs of Belleville springs assembled and tested by compression.
Springs of French manufacture.
Total height under initial load, 4″.85.

Applied loads.	Total compression.	Successive compression.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inch.*	*Inch.*	
500	0.	0.	0.	Initial load.
1,000	.0757	.0757	.....	
1,500	.1516	.0759	.....	
2,000	.2271	.0755	.....	
2,500	.3030	.0759	.....	
3,000	.3796	.0766	.....	
3,500	.4594	.0798	.....	
4,000	.5398	.0804	.....	
4,500	.6251	.0853	.....	
5,000	.7151	.0900	.....	
5,500	.8116	.0965	.....	
6,000	.9111	.0995	.0345	
6,500	1.0165	.1054	.....	
7,000	1.1333	.1168	.....	
7,500	1.2451	.1118	.....	
8,000	1.3568	.1117	.....	
8,500	1.4538	.0970	.....	
9,000	1.5179	.0641	.....	
9,500	1.5558	.0379	.....	
10,000	1.5864	.0306	.....	
10,500	1.6114	.0250	.....	
11,000	1.6368	.0254	.....	
15,000	1.7768	.1400	.....	
9,000	1.6144	.1624	.....	
6,000	1.3142	.3002	.2154	
	Loaded ten times with 15,000 pounds, releasing to 1,000 pounds between each.			
500	.....	.....	.3032	
1,000	.3851	.0819	.....	
1,500	.4672	.0821	.....	
2,000	.5453	.0781	.....	
2,500	.6246	.0793	.....	
3,000	.7055	.0809	.....	
3,500	.7919	.0864	.....	
4,000	.8811	.0892	.....	
4,500	.9711	.0900	.....	
5,000	1.0613	.0902	.....	
5,500	1.1543	.0930	.....	
6,000	1.2465	.0922	.....	
6,500	1.3381	.0916	.....	
7,000	1.4233	.0852	.....	
7,500	1.4969	.0736	.....	
8,000	1.5449	.0480	.....	
8,500	1.5776	.0327	.....	
9,000	1.6026	.0250	.....	
8,500	1.5826	.0200	.....	
8,000	1.5583	.0243	.....	
7,500	1.5244	.0339	.....	
7,000	1.4711	.0533	.....	
6,500	1.4041	.0670	.....	
6,000	1.3314	.0727	.....	
5,500	1.2476	.0838	.....	
5,000	1.1611	.0865	.....	
4,500	1.0746	.0865	.....	
4,000	.9814	.0932	.....	
3,500	.8898	.0916	.....	
3,000	.7986	.0912	.....	
2,500	.7023	.0963	.....	
2,000	.6070	.0953	.....	
1,500	.5108	.0962	.....	
1,000	.4126	.0982	.3054	
4,000	.8786	.5732	.2876	
1,000	.3716	.0840	.....	
2,000	.5281	.1565	.....	
3,000	.6938	.1657	.....	
4,000	.8596	.1658	.....	
5,000	1.0406	.1810	.....	
6,000	1.2271	.1865	.....	
7,000	1.4086	.1815	.....	
8,000	1.5361	.1275	.....	
9,000	1.5946	.0585	.....	

Belleville Springs.

Test No. 5165.





H Ex 161 52 1

No. 5165—Continued.

Applied loads.	Total compression.	Successive compression.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inch.*	*Inch.*	
8,000	1.5504	.0442	.....	
7,000	1.4591	.0913	.....	
6,000	1.3180	.1411	.....	
5,000	1.1504	.1676	.....	
4,000	.9702	.1802	.....	
3,000	.7805	.1897	.....	
2,000	.5932	.1873	.....	
1,000	.3978	.1954	.2916	

Test discontinued.

No. 5166.

Another set of six pairs of Belleville springs tested by compression, same manufacture and dimensions as those in test No. 5165.
Total height under initial load, 4″.65.

Applied loads.	Total compression.	Successive compression.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inch.*	*Inch.*	
500	0.	0.	0.	Initial load.
1,000	.0719	.0719	.....	
1,500	.1450	.0731	.....	
2,000	.2185	.0735	.....	
2,500	.2926	.0741	.....	
3,000	.3720	.0794	.....	
2,500	.3004	.0716	.....	
2,000	.2274	.0730	.....	
1,500	.1540	.0734	.....	
1,000	.0830	.0710	.0066	
1,000	.0824	.0758	.....	
1,500	.1528	.0704	.....	
2,000	.2260	.0732	.....	
2,500	.2991	.0731	.....	
3,000	.3732	.0741	.....	
3,500	.4554	.0822	.....	
4,000	.5393	.0839	.....	
4,500	.6288	.0895	.....	
5,000	.7221	.0933	.....	
4,500	.6489	.0732	.....	
4,000	.5710	.0779	.....	
3,500	.4931	.0779	.....	
3,000	.4135	.0796	.....	
2,500	.3364	.0771	.....	
2,000	.2522	.0842	.....	
1,500	.1804	.0718	.....	
1,000	.1050	.0754	.0231	
1,000	.0985	.0754	.....	
1,500	.1696	.0711	.....	
2,000	.2461	.0765	.....	
2,500	.3202	.0741	.....	
3,000	.3976	.0774	.....	
3,500	.4756	.0780	.....	
4,000	.5575	.0819	.....	
4,500	.6388	.0813	.....	
5,000	.7240	.0852	.....	
5,500	.8222	.0982	.....	
6,000	.9228	.1006	.....	
6,500	1.0247	.1019	.....	
7.000	1.1173	.0926	.....	
6,500	1.0661	.0512	.....	
6,000	1.0049	.0612	.....	
5,500	.9338	.0711	.....	
5,000	.8525	.0813	.....	
4,500	.7701	.0824	.....	
4,000	.6850	.0851	.....	

No. 5166—Continued.

Applied loads.	Total compression.	Successive compression.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inches.*	*Inches.*	
3,500	.6002	.0848	.....	
3,000	.5149	.0853	.....	
2,500	.4268	.0881	.....	
2,000	.3388	.0880	.....	
1,500	.2540	.0848	.....	
1,000	.1653	.0887	.0705	
1,000	.1482	.0777	.....	
1,500	.2217	.0735	.....	
2,000	.2964	.0747	.....	
2,500	.3740	.0776	.....	
3,000	.4535	.0795	.....	
2,500	.3790	.0745	.....	
2,000	.3030	.0760	.....	
1,500	.2252	.0778	.....	
1,000	.1504	.0748	.0713	
1,000	.1470	.0757	.....	
1,500	.2200	.0730	.....	
2,000	.2963	.0763	.....	
2,500	.3722	.0759	.....	
3,000	.4512	.0790	.....	
3,500	.5338	.0826	.....	
4,000	.6168	.0830	.....	
4,500	.7036	.0868	.....	
5,000	.7932	.0896	.....	
5,500	.8828	.0896	.....	
6,000	.9698	.0870	.....	
6,500	1.0478	.0780	.....	
7,000	1.1232	.0754	.....	
7,500	1.2070	.0838	.....	
8,000	1.2782	.0712	.....	
8,500	1.3330	.0548	.....	
9,000	1.3747	.0417	.....	
9,500	1.4102	.0355	.....	
10,000	1.4455	.0353	.....	
9,500	1.4272	.0183	.....	
9,000	1.4067	.0205	.....	
8,500	1.3822	.0245	.....	
8,000	1.3530	.0292	.....	
7,500	1.3237	.0293	.....	
7,000	1.2741	.0496	.....	
6,500	1.2207	.0534	.....	
6,000	1.1590	.0617	.....	
5,500	1.0910	.0680	.....	
5,000	1.0195	.0715	.....	
4,500	.9336	.0859	.....	
4,000	.8473	.0863	.....	
3,500	.7582	.0891	.....	
3,000	.6663	.0919	.....	
2,500	.5710	.0953	.....	
2,000	.4752	.0958	.....	
1,500	.3779	.0973	.....	
1,000	.2774	.1005	.1700	
1,000	.2467	.0767	.....	
1,500	.3238	.0771	.....	
2,000	.4008	.0770	.....	
2,500	.4805	.0797	.....	Rested 1 hour.
3,000	.5607	.0802	.....	
2,500	.4845	.0762	.....	
2,000	.4068	.0777	.....	
1,500	.3288	.0780	.....	
1,000	.2488	.0800	.1671	
2,000	.3973	.2302	.....	
15,000	1.63	1.2327	.....	Rested 14 hours.
8,500	1.4524	.1776	.....	
8,000	1.4278	.0246	.....	
7,500	1.3962	.0316	.....	
7,000	1.3624	.0338	.....	
6,500	1.3220	.0404	.....	
6,000	1.2760	.0460	.....	
5,500	1.2198	.0562	.....	
5,000	1.1556	.0642	.....	
4,500	1.0840	.0716	.....	
4,000	1.0085	.0755	.....	
3,500	.9208	.0877	.....	
3,000	.8296	.0912	.....	
2,500	.7272	.1024	.....	

No. 5166—Continued.

Applied loads.	Total compression.	Successive compression.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inch.*	*Inch.*	
2,000	.6241	.1031	.....	
1,500	.5153	.1088	.....	
1,000	.4040	.1113	.2858	
1,000	.3642	.0784	.....	
1,500	.4438	.0796	.....	
2,000	.5241	.0803	.....	
2,500	.6075	.0834	.....	
3,000	.6910	.0835	.....	
2,500	.6130	.0780	.....	
2,000	.5327	.0803	.....	
1,500	.4510	.0817	.....	
1,000	.3698	.0812	.2838	
1,000	.3641	.0803	.....	
1.500	.4434	.0793	.....	
2,000	.5240	.0806	.....	
2,500	.6047	.0807	.....	
3,000	.6885	.0838	.....	
3,500	.7730	.0845	.....	
4,000	.8590	.0860	.....	
4,500	.9437	.0847	.....	
5,000	1.0188	.0751	.....	
5,500	1.0948	.0760	.....	
6,000	1.1661	.0713	.....	
6,500	1.2306	.0645	.....	
7,000	1.2857	.0551	.....	
6,500	1.2456	.0401	.....	
6,000	1.1945	.0511	.....	
5,500	1.1374	.0571	.....	
5,000	1.0710	.0664	.....	
4,500	1.0027	.0683	.....	
4,000	.9231	.0796	.....	
4,500	.9970	.0739	.....	
5,000	1.0620	.0650	.....	
5,500	1.1261	.0641	.....	
6,000	1.1857	.0596	.....	
6,500	1.2397	.0540	.....	
6,000	1.1927	.0470	.....	
5,500	1.1372	.0555	.....	
5,000	1.0712	.0660	.....	
4,500	1.0035	.0677	.....	
4,000	.9275	.0760	.....	
3,500	.8422	.0853	.....	
3,000	.7548	.0874	.....	
2,500	.6680	.0868	.....	
2,000	.5760	.0920	.....	
1,500	.4844	.0916	.....	
1,000	.3908	.0936	.2907	

Test discontinued.

No. 5281.

Five pairs of Belleville springs assembled and tested by compression.

Springs of English manufacture, for use in the Easton & Anderson 12-inch mortar carriage.

Weight of five pairs, 66 pounds; exterior diameter, 8″.73; interior diameter, 2″.37.

Conicity, ″.23 each.

Thickness of springs, ″.41.

Height of five pairs under initial load, 6″.52.

Applied loads.	Total compression.	Successive compression.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inch.*	*Inch.*	
500	0.	0.	0.	Initial load.
1,000	.0375	.0375	.....	
2,000	.0928	.0553	.....	
3,000	.1456	.0528	.....	
4,000	.1960	.0504	.....	
5,000	.2477	.0517	.0070	
6,000	.3004	.0527	.....	
7,000	.3531	.0527	.....	
8,000	.4060	.0529	.....	
9,000	.4598	.0538	.....	
10,000	.5137	.0539	.0129	
11,000	.5677	.0540	.....	
12,000	.6230	.0553	.....	
13,000	.6780	.0550	.....	
14,000	.7342	.0562	.....	
15,000	.7921	.0579	.0182	
16,000	.8603	.0682	.....	
17,000	.9073	.0470	.....	
18,000	.9610	.0537	.....	
19,000	1.0208	.0598	.....	
20,000	1.0793	.0585	.0233	
21,000	1.1375	.0582	.....	
22,000	1.1981	.0606	.....	
23,000	1.2603	.0622	.....	
24,000	1.3253	.0650	.....	
25,000	1.3903	.0650	.0355	
5,000	.....	.....	.....	Rested under this load 14 hours.
26,000	1.4463	.0560	.....	
27,000	1.5071	.0608	.....	
28,000	1.5693	.0622	.....	
29,000	1.6287	.0594	.....	
30,000	1.6859	.0572	.0412	
31,000	1.7333	.0474	.....	
32,000	1.7731	.0398	.....	
33,000	1.8148	.0417	.....	
34,000	1.8496	.0348	.....	
35,000	1.8805	.0309	.0930	
36,000	1.9059	.0254	.....	
37,000	1.9340	.0281	.....	
38,000	1.9447	.0107	.....	
39,000	1.9614	.0167	.....	
40,000	1.9771	.0157	.1407	
41,000	1.9934	.0163	.....	
42,000	2.0069	.0135	.....	
43,000	2.0194	.0125	.....	
44,000	2.0290	.0096	.....	
45,000	2.0369	.0079	.....	
46,000	2.0458	.0089	.....	
47,000	2.0539	.0081	.....	
48,000	2.0586	.0047	.....	
49,000	2.0641	.0055	.....	
50,000	2.0711	.0070	.1977	
Loaded with 50,000 pounds ten times.				
500	.....	.....	.2853	
1,000	.3183	.0330	.....	
2,000	.3713	.0530	.....	
3,000	.4250	.0537	.....	
4,000	.4776	.0526	.....	
5,000	.5296	.0520	.....	
6,000	.5837	.0541	.....	
7,000	.6380	.0543	.....	
8,000	.6916	.0536	.....	
9,000	.7455	.0539	.....	

No. 5281—Continued.

Applied loads.	Total compression.	Successive compression.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inch.*	*Inch.*	
10,000	.8010	.0555	.....	
11,000	.8560	.0550	.....	
12,000	.9117	.0557	.....	
13,000	.9670	.0553	.....	
14,000	1.0211	.0541	.....	
15,000	1.0790	.0579	.....	
16,000	1.1358	.0568	.....	
17,000	1.1910	.0552	.....	
18,000	1.2493	.0583	.....	
19,000	1.3050	.0557	.....	
20,000	1.3620	.0570	.....	
21,000	1.4200	.0580	.....	
22,000	1.4770	.0570	.....	
23,000	1.5320	.0550	.....	
24,000	1.5870	.0550	.....	
25,000	1.6380	.0510	.....	
26,000	1.6858	.0478	.....	
27,000	1.7290	.0432	.....	
28,000	1.7700	.0410	.....	
29,000	1.8092	.0392	.....	
30,000	1.8415	.0323	.....	
29,000	1.8060	.0355	.....	
28,000	1.7880	.0180	.....	
27,000	1.7570	.0310	.....	
26,000	1.7220	.0350	.....	
25,000	1.6851	.0369	.....	
24,000	1.6460	.0391	.....	
23,000	1.6030	.0430	.....	
22,000	1.5582	.0448	.....	
21,000	1.5111	.0471	.....	
20,000	1.4633	.0478	.....	
19,000	1.4127	.0506	.....	
18,000	1.3612	.0515	.....	
17,000	1.3099	.0513	.....	
16,000	1.2568	.0531	.....	
15,000	1.2030	.0538	.....	Rested under this load thirty minutes.
14,000	1.1490	.0540	.....	
13,000	1.0915	.0575	.....	
12,000	1.0362	.0553	.....	
11,000	.9780	.0582	.....	
10,000	.9195	.0585	.....	
9,000	.8572	.0623	.....	
8,000	.7957	.0615	.....	
7,000	.7330	.0627	.....	
6,000	.6677	.0653	.....	
5,000	.6045	.0632	.....	
4,000	.5393	.0652	.....	
3,000	.4620	.0773	.....	
2,000	.4025	.0595	.....	
1,000	.3314	.0711	.....	
500	.....	.....	.2870	

Test discontinued.

No. 5282.

Retest of four pairs of Belleville springs.

The original test of these springs is published in Report of Tests, 1890.

Original dimensions: Exterior diameter, 8″.60; interior diameter, 2″.37; conicity, ″.23 each; thickness of springs, ″.42.

Original height of four pairs under initial load, 5″.27.

Present height of four pairs under initial load, 5″.15.

Applied loads.	Total compression.	Successive compression.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inch.*	*Inch.*	
500	0.	0.	0.	Initial load.
1,000	.0341	.0341	.....	
2,000	.0747	.0406	.....	
3,000	.1160	.0413	.....	
4,000	.1545	.0385	.....	
5,000	.1943	.0398	.....	
6,000	.2338	.0395	.....	
7.000	.2727	.0389	.....	
8,000	.3135	.0408	.....	
9.000	.3522	.0387	.....	
10,000	.3927	.0405	.....	
11,000	.4324	.0397	.....	
12,000	.4727	.0403	.....	
13.000	.5132	.0405	.....	
14,000	.5544	.0412	.....	
15,000	.5952	.0408	.....	
16.000	.6373	.0421	.....	
17,000	.6795	.0422	.....	
18,000	.7226	.0431	.....	
19,000	.7663	.0437	.....	
20,000	.8106	.0443	.....	
21,000	.8553	.0447	.....	
22,000	.9012	.0459	.....	
23,000	.9472	.0460	.....	
24,000	.9944	.0472	.....	
25,000	1.0427	.0483	.....	
26,000	1.0919	.0492	.....	
27,000	1.1419	.0500	.....	
28,000	1.1921	.0502	.....	
29,000	1.2478	.0557	.....	
30,000	1.2960	.0482	.....	
29.000	1.2609	.0351	.....	
28,000	1.2250	.0359	.....	
27.000	1.1886	.0364	.....	
26.000	1.1496	.0390	.....	
25,000	1.1086	.0410	.....	
24.000	1.0686	.0400	.....	
23,000	1.0261	.0425	.....	
22,000	.9866	.0395	.....	
21,000	.9458	.0408	.....	
20,000	.9035	.0423	.....	
19,000	.8626	.0409	.....	
18,000	.8214	.0412	.....	
17,000	.7793	.0421	.....	
16,000	.7371	.0422	.....	
15,000	.6956	.0415	.....	
14,000	.6528	.0428	.....	
13,000	.6106	.0422	.....	
12,000	.5681	.0425	.....	
11,000	.5244	.0437	.....	
10,000	.4811	.0433	.....	
9,000	.4364	.0447	.....	
8,000	.3919	.0445	.....	
7,000	.3467	.0452	.....	
6,000	.3010	.0457	.....	
5,000	.2536	.0474	.....	
4,000	.2077	.0459	.....	
3,000	.1593	.0484	.....	
2,000	.1099	.0494	.....	
1,000	.0592	.0507	.0298	
50,000	.....	.....	.....	Springs closed down.
Rested under 50,000 pounds load 14 hours, the load in the meantime falling to 38,000 pounds.				
500	.....	.....	.0479	
1,000	.0747	.0268	.....	
2,000	.1155	.0408	.....	
4,000	.1963	.0808	.....	

No. 5282—Continued.

Applied loads.	Total compression.	Successive compression.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inch.*	*Inch.*	
6,000	.2745	.0782	.....	
8,000	.3564	.0819	.....	
10,000	.4373	.0809	.....	
12,000	.5194	.0821	.....	
14,000	.6002	.0808	.....	
16,000	.6837	.0835	.....	
18,000	.7699	.0862	.....	
20,000	.8565	.0866	.....	
22,000	.9478	.0913	.....	
24,000	1.0402	.0924	.....	
26,000	1.1341	.0939	.....	
28,000	1.2326	.0985	.....	
30,000	1,3307	.0981	.....	
28,000	1.2606	.0701	.....	
26,000	1.1821	.0785	.....	
24,000	1.0999	.0822	.....	
22,000	1.0159	.0840	.....	
20,000	.9349	.0810	.....	
18,000	.8522	.0827	.....	
16,000	.7691	.0831	.....	
14,000	.6836	.0855	.....	
12,000	.5966	.0870	.....	
10,000	.5101	.0865	.....	
8,000	.4192	.0909	.....	
6,000	.3276	.0916	.....	
4,000	.2337	.0939	.....	
2,000	.1337	.1000	.....	
1,000	.0770	.0567	.0289	

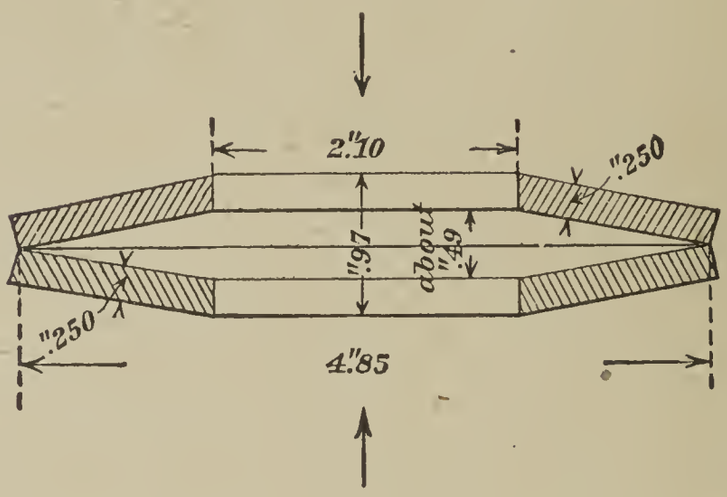
Test discontinued.

TEST OF PAIR OF BELLEVILLE SPRINGS MADE FROM SAME STEEL AS TEST NO. 4694.

SPRINGS MANUFACTURED AT WATERTOWN ARSENAL FOR 5-INCH SIEGE CARRIAGE.

[Springs were tempered in oil.]

No. 4695.

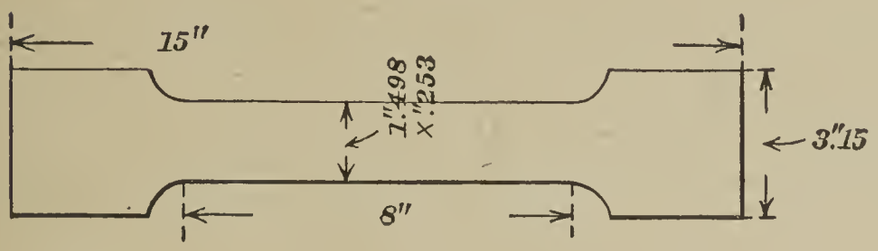


Applied loads.	Compression.	Successive compression.	Permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	*Inch.*	
200	0.	0.	0.	Initial load.
400	.0054	.0054	.....	
600	.0087	.0033	.....	
800	.0104	.0017	.....	
1,000	.0130	.0026	.0004	
2,000	.0244	.0114	.0008	
3,000	.0352	.0108	.0015	
4,000	.0462	.0110	.0023	
5,000	.0570	.0108	.0022	
6,000	.0687	.0117	.0034	
7,000	.0822	.0135	.0042	
8,000	.0964	.0142	.0057	
1,000	.0177	—.0787	.....	
2,000	.0295	+.0118	.....	
3,000	.0397	.0102	.....	
4,000	.0506	.0109	.....	
5,000	.0616	.0110	.....	
6,000	.0729	.0113	.....	
7,000	.0845	.0116	.....	
6,000	.0758	—.0087	.....	
5,000	.0645	—.0113	.....	
4,000	.0531	—.0114	.....	
3,000	.0417	—.0114	.....	
2,000	.0306	—.0111	.....	
1,000	.0194	—.0112	.....	Test discontinued.

Scale started off near the holes in the springs.

PLATE REPRESENTING METAL USED IN BELLEVILLE SPRINGS.

No. 4694.



Sectional area, .379 square inch.
Elastic limit, 16,870 pounds = 44,510 pounds per square inch.
Tensile strength, 32,840 pounds = 86,650 pounds per square inch.
Elongation in 8 inches, .″53=6.6 per cent.
Elongation of inch sections, ″.03, ″.04, ″.05 ″.12, ″.15, ″.04, ″.05, ″.03.
Area at fracture, 1″.43×″.237=.339 square inch.
Contraction of area, 10.6 per cent.
Appearance of fracture, granular, radiating from one corner.

No. 5245.

Marks, $\frac{10\ R,\ J}{B\ T\ R}$

Measurements of diameters.

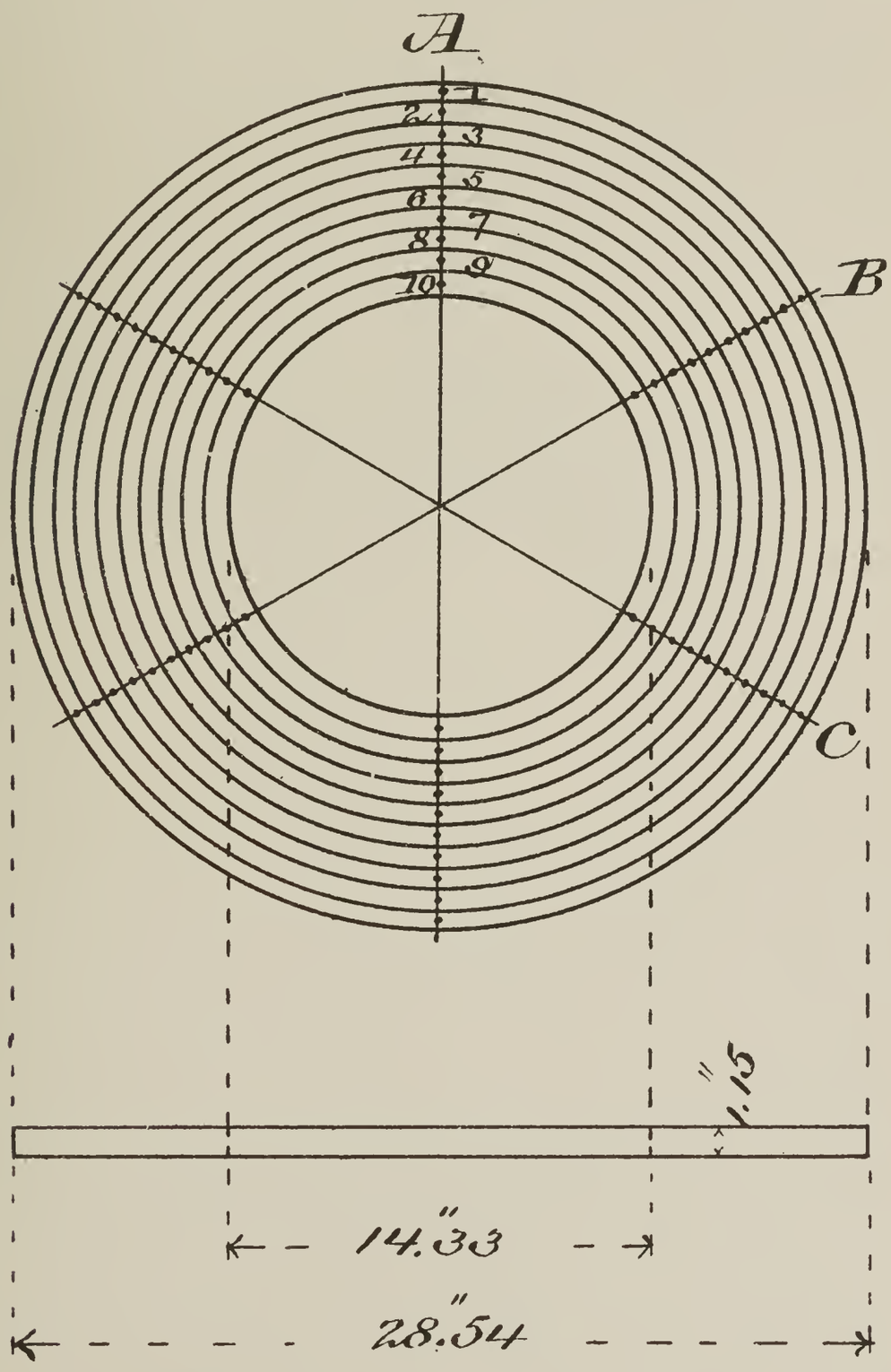
Ring.	Diameters.				Compression stress per square inch.
	A	B	C	Mean.	
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Pounds.*
No. 10, in slice	(*)	15.0612	15.0495	15.05535	.....
No. 10, detached	.....	15.0621	15.0505	15.05630	.....
Differences	.....	+.0009	+.0010	+.00095	1,890
No. 9, in slice	16.4837	16.4762	16.4958	16.48523	.....
No. 9, detached	16.4847	16.4777	16.4965	16.48630	.....
Differences	+.0010	+.0015	+.0007	+.00107	1,957
No. 8, in slice	17.9004	17.9069	17.9223	17.90987	.....
No. 8, detached	17.9001	17.9087	17.9231	17.91063	.....
Differences	—.0003	+.0018	+.0008	+.00076	1,273
No. 7, in slice	19.2962	19.3149	19.3081	19.30640	.....
No. 7, detached	19.2973	19.3165	19.3080	19.30727	.....
Differences	+.0011	+.0016	—.0001	+.00087	1,352
No. 6, in slice	20.7180	20.7361	20.7405	20.73153	.....
No. 6, detached	20.7180	20.7355	20.7415	20.73166	.....
Differences	0.	—.0006	+.0010	+.00013	188
No. 5, in slice	22.1228	22.1265	22.1320	22.12710	.....
No. 5, detached	22.1232	22.1268	22.1327	22.12757	.....
Differences	+.0004	+.0003	+.0007	.00047	638
No. 4, in slice	(*)	23.5757	23.5787	23.5772	.....
No. 4, detached	.....	23.5766	23.5820	23.5793	.....
Differences	.....	+.0009	+.0033	+.0021	1,532
No. 3, in slice	24.9873	25.0001	24.9811	24.98950	.....
No. 3, detached	24.9883	25.0006	24.9809	24.98993	.....
Differences	+.0010	+.0005	—.0002	+.00043	516
No. 2, in slice	26.3960	26.4037	26.4240	26.40790	.....
No. 2, detached	26.3939	26.4049	26.4280	26.40893	.....
Differences	—.0021	+.0012	+.0040	+.00103	1,170
No. 1, in slice	27.8290	27.8233	27.8242	27.82550	.....
No. 1, detached	27.8404	27.8169	27.8238	27.82703	.....
	+.0114	—.0064	—.0004	+.00153	1,651

* These diameters were disturbed by the lathe tool when cutting out the rings.

10 inch Steel B. L. Rifle.

Initial tension ring from Jacket forging, Breech end

No. 5245

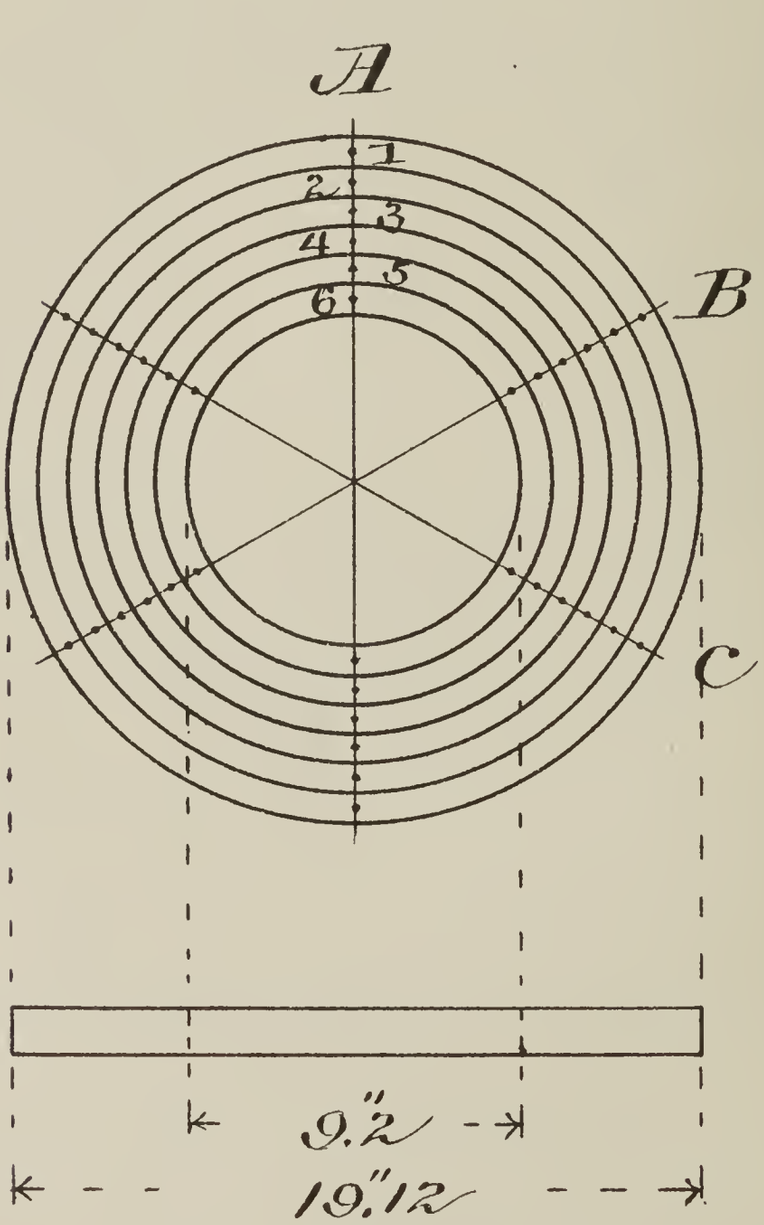


I Ex 161 52 1

10 inch Steel B. L. Rifle.

Initial tension ring from Tube forging, Breech end.

No. 5364



H Ex 161 52 1

No. 5364.

Marks, $\overset{10\ R_2\ T}{B\ T\ R}$

Measurements of diameters.

Ring.	Diameters.				Stress per square inch.	
	A	B	C	Mean.	Tension.	Compression.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
No. 6, in slice	10.0224	10.0307	10.0280	10.02703	.....	.....
No. 6, detached	10.0222	10.0311	10.0277	10.02700	.....	.....
Differences	—.0002	+.0004	—.0003	—.0003	90	.....
No. 5, in slice	11.6750	11.6740	11.6710	11.67333	.....	.....
No. 5, detached	11.6755	11.6743	11.6717	11.67383	.....	.....
Differences	+.0005	+.0003	+.0007	+.00050	.....	1,290
No. 4, in slice	13.3274	13.3247	13.3227	13.32493	.....	.....
No. 4, detached	13.3277	13.3242	13.3221	13.32467	.....	.....
Differences	+.0003	—.0005	—.0006	—.00026	590	.....
No. 3, in slice	14.9539	14.9295	14.9535	14.94563	.....	.....
No. 3, detached	14.9520	14.9291	14.9520	14.94437	.....	.....
Differences	—.0019	—.0004	—.0015	—.00126	2,530	.....
No. 2, in slice	16.5929	16.5948	16.5979	16.59520	.....	.....
No. 2, detached	16.5909	16.5934	16.5961	16.59347	.....	.....
Differences	—.0020	—.0014	—.0018	—.00173	3,130	.....
No. 1, in slice	18.2622	18.2450	18.2500	18.25240	.....	.....
No. 1, detached	18.2648	18.2405	18.2533	18.25287	.....	.....
Differences	+.0026	—.0045	+.0033	+.00047	.....	770

INITIAL STRAINS IN DISCS

TAKEN FROM

A $3\frac{3}{4}$-INCH COLD-ROLLED IRON BAR.

Fifteen disks were cut from a cold-rolled iron bar, and from the rim of each disk a ring $\frac{1}{4}$-inch thickness was taken.

The internal strains in these rings were determined with the metal in the condition it existed in the bar, also after the cylindrical surface of two of the disks had been peined with a hand hammer, and after others had been annealed at temperatures ranging from 368 to 1,408 degrees Fahr.

Certain rings were turned out from the interior, reducing the thickness of metal to ″.17, the changes in diameters being observed both when the ring was first detached from the disk and after the subsequent reduction.

The stresses corresponding to the strains released were computed, assuming for the purpose a modulus of elasticity of 27,000,000 pounds per square inch.

Some rings were cut apart radially, the expansion of chord measurement across the cut showing additional strains were released.

In disks A, B, and C, taken from the bar in its ordinary cold-rolled condition, the compression stresses ranged from 12,030 pounds per square inch, to 15,300 pounds per square inch, and the strains were well distributed over the thickness of metal in the rings, as shown by their behavior when reduced in thickness.

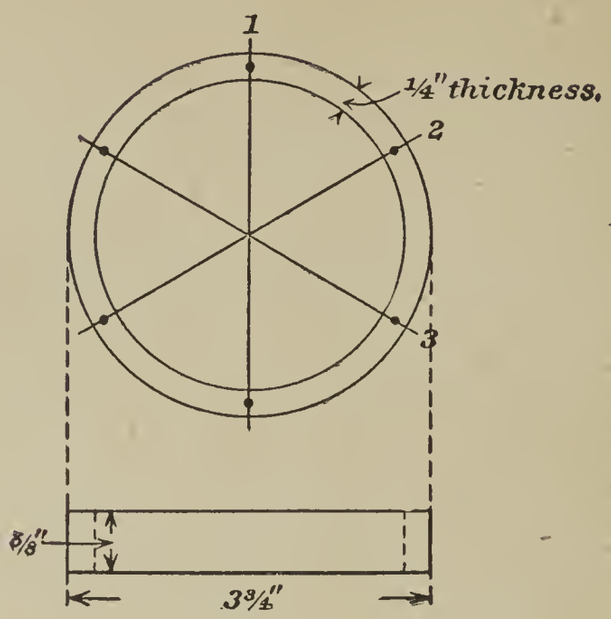
The metal was evidently capable of retaining, at least for the time being, more intense strains, which in peined disk D, when reduced to ″.17 thickness, amounted to 23,670 pounds per square inch.

In the rings from both D and E the strains appear to have been sensibly greater near the peined surface than at a depth of $\frac{1}{4}$ inch.

The effect of annealing at the higher temperatures employed was very marked.

After having been heated to 1,408 degrees Fahr. the stresses in ring G were reduced to 994 pounds per square inch, and those rings exposed to lower temperatures down to 852 degrees Fahr. appear to have had their internal strains diminished. Below 852 degrees Fahr. there was irregular behavior.

SKETCH OF RINGS TAKEN FROM DISKS.



Disk A.

Ring.	Diameters.				Corresponding compression stress per square inch.
	1	2	3	Mean.	
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Pounds.*
In disk	3.5216	3.5286	3.5220	3.52406	.....
Detached	3.5236	3.5298	3.5238	3.52573	.....
Differences	+.0020	+.0012	+.0018	+.00167	12.790
Turned out on inside to ".17 thickness	3.5233	3.5297	3.5239	3.52563	.....
Total differences	+.0017	+.0011	+.0019	+.00157	12.030

Chord 1—2 expanded ",0052 when ring was cut apart radially.

Disk B.

In disk	3.5355	3.5329	3.5333	3.53390	.....
Detached	3.5377	3.5357	3.5340	3.53580	.....
Differences	+.0022	+.0028	+.0007	+.00190	14,520
Turned out on inside to ".17 thickness	3.5376	3.5363	3.5330	3.53563	.....
Total differences	+.0021	+.0034	—.0003	+.00173	13,220

Disk C.

Before peining	3.5355	3.5279	3.5263	3.52990	.....
After peining	3.5353	3.5283	3.5265	3.53003	.....
Differences	—.0002	+.0004	+.0002	+.00013	.....
Detached	3.5355	3.5297	3.5299	3.53170	.....
Differences	+.0002	+.0014	+.0034	+.00167	12,770
Turned out on inside to ".17 thickness	3.5370	3.5296	3.5295	3.53203	.....
Total differences	+.0017	+.0013	+.0030	+.00200	15,300

Disk D.

Ring.	Diameters.				Corresponding compression stress per square inch.
	1	2	3	Mean.	
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Pounds.*
Before peining	3.5381	3.5358	3.5359	3.53660	.....
After peining	3.5376	3.5356	3.5340	3.53573	.....
Differences	—.0005	—.0002	—.0019	—.00087	.....
Detached	3.5432	3.5378	3.5340	3.53833	.....
Differences	+.0056	+.0022	.0000	+.00260	19,850
Turned out on inside to ″.17 thickness	3.5506	3.5387	3.5272	3.53883	.....
Total differences	+.0130	+.0031	—.0068	+.00310	23,670

Disk E.

Before peining	3.5284	3.5366	3.5287	3.53123	.....
After peining	3.5282	3.5363	3.5286	3.53103	.....
Differences	—.0002	—.0003	—.0001	—.00020	.....
Detached	3.5304	3.5381	3.5301	3.53286	.....
Differences	+.0022	+.0018	+.0015	+.00183	13,990
Turned out on inside to ″.17 thickness	3.5311	3.5390	3.5300	3.53336	.....
Total differences	+.0029	+.0027	+.0014	+.00233	17,820

Disk F.

Heated to an estimated temperature of 1,208° Fahr. and cooled in air, which caused a decrease of ″.0003 in the mean diameter.

In disk	3.5363	3.5255	3.5284	3.53007	.....
Detached	3.5362	3.5262	3.5294	3.53060	.....
Differences	—.0001	+.0007	+.0010	+.00053	4,050

Chord 1—2 expanded ″.0103 when ring was cut apart radially.

Disk G.

Heated to an estimated temperature of 1,408° Fahr. and cooled in air, which caused a decrease of ″.0001 in the mean diameter.

In disk	3.5310	3.5355	3.5260	3.53083	.....
Detached	3.5313	3.5355	4.5261	3.53096	.....
Differences	+.0003	.0000	+.0001	+.00013	994

Chord 1—2 expanded ″.0013 when ring was cut apart radially.

Disk H.

Heated to an estimated temperature of 628° Fahr. and cooled in air, which caused a decrease of ″.00013 in mean diameter.

Ring.	Diameters.				Corresponding compression stress per square inch.
	1	2	3	Mean.	
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Pounds.*
In disk	3.4883	3.4705	3.4875	3.48210	.....
Detached	4.4895	3.4726	3.4889	3.48367	.....
Differences	+.0012	+.0021	+.0014	+.00157	12,170

Chord 1—2 expanded ″.0146 when ring was cut apart radially.

Disk I.

Heated to an estimated temperature of 516° Fahr. and cooled in air, which caused an increase of ″.0001 in mean diameter.

In disk	3.4854	3.4890	3.4934	3.48927	.....
Detached	3.4860	3.4904	3.4944	3.49027	.....
Differences	+.0006	+.0014	+.0010	+.00100	7,740

Chord 1—2 expanded ″.0124 when ring was cut apart radially.

Disk J.

Heated to an estimated temperature of 540° Fahr. and cooled in air, which caused an increase of ″.00014 in mean diameter.

In disk	3.4890	3.4749	3.4814	3.48177	.....
Detached	3.4904	3.4769	3.4829	3.48340	.....
Differences	+.0014	+.0020	+.0015	+.00163	12,640

Chord 1—2 expanded ″.0116 when ring was cut apart radially.

Disk K.

Heated to an estimated temperature of 368° Fahr. and cooled in air, which caused an increase of ″.00003 in mean diameter.

In disk	3.4929	3.4874	3.4880	3.48943	.....
Detached	3.4945	3.4896	3.4881	3.49073	.....
Differences	+.0016	+.0022	+.0001	+.00130	10,060

Chord 1—2 expanded ″.0070 when ring was cut apart radially.

Disk L.

Heated to an estimated temperature of 660° Fahr. and cooled in air, which caused a decrease of ″.0001 in mean diameter.

Ring.	Diameters.				Corresponding compression stress per square inch.
	1	2	3	Mean.	
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Pounds.*
In disk	3.4860	3.4877	3.4819	3.48520	.....
Detached	4.4866	3.4905	3.4834	3.48683	.....
Differences	+.0006	+.0028	+.0015	+.00163	12,630

Chord 1—2 expanded ″.0139 when ring was cut apart radially.

Disk M.

Heated to an estimated temperature of 852° Fahr. and cooled in air, which caused an increase of ″.00034 in mean diameter.

In disk	3.4915	3.4852	3.4800	3.48557	.....
Detached	3.4941	3.4855	3.4800	3.48653	.....
Differences	+.0026	+.0003	.0000	+.00096	7,440

Chord 1—2 expanded ″.0104 when ring was cut apart radially.

Disk N.

Heated to an estimated temperature of 876° Fahr. and cooled in air, which caused an increase of ″.00026 in mean diameter.

In disk	3.4847	3.4810	3.4810	3.48223	.....
Detached	3.4859	3.4814	3.4829	3.48340	.....
Differences	+.0012	+.0004	+.0019	+.00117	9,070

Chord 1—2 expanded ″.0082 when ring was cut apart radially.

Disk O.

Heated to an estimated temperature of 1,156° Fahr. and cooled in air, which caused an increase of ″.0001 in mean diameter.

In disk	3.4875	3.4879	3.4725	3.48263	.....
Detached	3.4889	3.4889	3.4730	3.48360	.....
Differences	+.0014	+.0010	+.0005	+.00097	7,520

Chord 1—2 expanded ″.0101 when ring was cut apart radially.

STEEL SHELL CASTINGS.

SPECIMENS FURNISHED BY LANG, GOODHUE & CO.,
BURLINGTON, VT.

No. 4384.

Mark, •
Diameter, ″.510.
Sectional area, .204 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
204	1,000	0.	0.	0.	0.	Initial load.
1,020	5,000	.000100	.000100	0.	.....	
2,040	10,000	.000350	.000250	.....	.....	
3,060	15,000	.000550	.000200	.....	.....	
4,080	20,000	.000800	.000250	0.	.....	
5,100	25,000	.001000	.000200	.....	.....	
6,120	30,000	.001300	.000300	.000150	.000150	
6,304	31,000	.001350	.000050	.....	.....	
6,508	32,000	.001450	.000100	.....	.....	
6,712	33,000	.001500	.000050	.....	.....	Elastic limit.
6,916	34,000	.001750	.000250	.....	.....	
7,140	35,000	.002300	.000550	.001100	.000950	
7,344	36,000	.003300	.001000	.....	.....	
7,548	37,000	.004000	.000700	.....	.....	
7,752	38,000	.004600	.000600	.....	.....	
7,956	39,000	.005500	.000900	.....	.....	
8,160	40,000	.006050	.000550	.004500	.003400	
8,364	41,000	.006450	.000400	.....	.....	
8,568	42,000	.006750	.000300	.....	.....	
8,772	43,000	.007600	.000850	.....	.....	
8,976	44,000	.008350	.000750	.....	.....	
9,180	45,000	.009100	.000750	.....	.....	
9,384	46,000	.009600	.000500	.....	.....	
9,588	47,000	.010400	.000800	.....	.....	
9,792	48,000	.011000	.000600	.....	.....	
9,996	49,000	.011500	.000500	.....	.....	
10,200	50,000	.012100	.000600	.010000	.005500	
10,404	51,000	.012550	.000450	.....	.....	
10,608	52,000	.013150	.000600	.....	.....	
10,812	53,000	.014000	.000850	.....	.....	
11,016	54,000	.014750	.000750	.....	.....	
11,220	55,000	.015400	.000650	.....	.....	
11,424	56,000	.016100	.000700	.....	.....	
11,628	57,000	.017050	.000950	.....	.....	
11,832	58,000	.017600	.000550	.....	.....	
12,036	59,000	.018500	.000900	.....	.....	
12,240	60,000	.019500	.001000	.....	.....	
14,060	68,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	68,920
Elastic limit per square inch of original section	do....	33,000
Elongation per inch after rupture	inch..	.0200
Elongation per inch under strain at elastic limit	do....	.001500
Reduction in diameter at point of rupture	do....	.010
Reduction in area after rupture, per cent of original section		3.9
Position of rupture		at the neck
Character of broken surface	granular, surface thickly studded with small cavities ″.01+diameter	
Elongation of inch sections		″.02, ″.02*

No. 912.

Mark, •
Length, 5″.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	0.	0.	Initial load.
2,500	5,000	.000050	.000050	.....	.....	
5,000	10,000	.000125	.000065	.....	.....	
7,500	15,000	.000250	.000125	.....	.....	
10,000	20,000	.000450	.000200	.000075	.000075	
12,500	25,000	.000675	.000225	.....	.....	
15,000	30,000	.000925	.000250	.000100	.000025	
15,500	31,000	.001000	.000075	.....	.....	
16,000	32,000	.001050	.000050	.....	.....	
16,500	33,000	.001125	.000075	.....	.....	
17,000	34,000	.001200	.000075	.....	.....	Elastic limit, approximate.
17,500	35,000	.001325	.000125	.0000250	.000150	
18,000	36,000	.001550	.000225	.....	.....	
18,500	37,000	.001925	.000375	.....	.....	
19,000	38,000	.003875	.001950	.....	.....	
19,500	39,000	.004625	.000750	.....	.....	
20,000	40,000	.005000	.000375	.003575	.003325	
20,500	41,000	.005475	.000475	.....	.....	
21,000	42,000	.005800	.000325	.....	.....	
21,500	43,000	.006300	.000500	.....	.....	
22,000	44,000	.006775	.000475	.....	.....	
22,500	45,000	.007250	.000475	.005550	.001975	
23,000	46,000	.007625	.000375	.....	.....	
23,500	47,000	.008125	.000500	.....	.....	
24,000	48,000	.008575	.000450	.....	.....	
24,500	49,000	.009200	.000625	.....	.....	
25,000	50,000	.009625	.000425	.007675	.002125	
26,000	52,000	.010525	.000900	.....	.....	
27,000	54,000	.011625	.001100	.....	.....	
28,000	56,000	.012700	.001075	.....	.....	
29,000	58,000	.013600	.000900	.....	.....	
30,000	60,000	.014875	.001275	.012425	.004750	
45,080	90,160	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4385.

Marks, • •
Diameter, ″.515.
Sectional area, .208 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
208	1,000	0.	0.	0.	0	Initial load.
1,040	5,000	.000150	.000150	0.	.....	
2,080	10,000	.000400	.000250	.....	.....	
3,120	15,000	.000550	.000150	.....	.....	
4,160	20,000	.000700	.000150	.....	.....	
5,200	25,000	.000950	.000250	0.	.....	
6,240	30,000	.001250	.000300	.000100	.000100	
6,448	31,000	.001300	.000050	.....	.....	
6,656	32,000	.001400	.000100	.....	.....	
6,864	33,000	.001450	.000050	.....	.....	Elastic limit.
7,072	34,000	.001800	.000350	.....	.....	
7,280	35,000	.002500	.000700	.001050	.000950	
7,488	36,000	.003050	.000550	.....	.....	
7,696	37,000	.003900	.000850	.....	.....	
7,904	38,000	.004500	.000600	.....	.....	
8,112	39,000	.005000	.000500	.....	.....	
8,320	40,000	.005500	.000500	.003850	.002800	
8,528	41,000	.005900	.000400	.....	.....	
8,736	42,000	.006400	.000500	.....	.....	
8,944	43,000	.006900	.000500	.....	.....	
9,152	44,000	.007500	.000600	.....	.....	
9,360	45,000	.008050	.000550	.....	.....	
9,568	46,000	.008550	.000500	.....	.....	
9,776	47,000	.009250	.000700	.....	.....	
9,984	48,000	.010000	.000750	.....	.....	
10,120	48,650	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	48,650
Elastic limit per square inch of original section	do....	33,000
Elongation per inch after rupture	inch..	.0100
Elongation per inch under strain at elastic limit	do....	.001450
Reduction in diameter at point of rupture	do....	.005
Reduction in area after rupture, per cent of original section		1.9
Position of rupture		″.75 from the neck
Character of broken surface....granular, surface thickly studded with small cavities ″.01 + diameter		
Elongation of inch sections		″.01, ″.01

No. 913.

Marks, ••
Length, 5″.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	0.	0.	Initial load.
2,500	5,000	.000050	.000050	.....	.....	
5,000	10,000	.000225	.000175	.....	.....	
7,500	15,000	.000375	.000150	.....	.....	
10,000	20,000	.000525	.000150	.000050	.000050	
12,500	25,000	.000725	.000200	.....	.....	
15,000	30,000	.001050	.000325	.000075	.000025	Elastic limit, approximate.
15,500	31,000	.001150	.000100	.....	.....	
16,000	32,000	.001250	.000100	.....	.....	
16,500	33,000	.001450	.000200	.....	.....	
17,000	34,000	.001700	.000250	.....	.....	
17,500	35,000	.002075	.000375	.000850	.000775	
18,000	36,000	.002600	.000525	.....	.....	
18,500	37,000	.003200	.000600	.....	.....	
19,000	38,000	.003700	.000500	.....	.....	
19,500	39,000	.004275	.000575	.....	.....	
20,000	40,000	.004700	.000425	003200	.002350	
21,000	42,000	.005525	.000825	.....	.....	
22,000	44,000	.006500	.000975	.....	.....	
23,000	46,000	.007500	.001000	.....	.....	
24,000	48,000	.008500	.001000	.....	.....	
25,000	50,000	.009525	.001025	.007500	.004300	
26,000	52,000	.010325	.000800	.....	.....	
27,000	54,000	.011375	.001050	.....	.....	
28,000	56,000	.012550	.001175	.....	.....	
29,000	58,000	.013600	.001050	.....	.....	
30,000	60,000	.014875	.001275	.012025	.004525	
31,000	62,000	.015425	.000550	.....	.....	
32,000	64,000	.017000	.001575	.....	.....	
33,000	66,000	.018375	.001375	.....	.....	
34,000	68,000	.019575	.001200	.....	.....	
35,000	70,000	.021075	.001500	.017875	.005850	
47,240	94,480	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4494.

Mark, A.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	0.	.....	
3,000	15,000	.000450	.000150	0.	.....	
4,000	20,000	.000600	.000150	0.	.....	
5,000	25,000	.000850	.000250	0.	.....	
6,000	30,000	.001100	.000250	.000100	.000100	Elastic limit.
6,200	31,000	.001950	.000850	.....	.....	
6,400	32,000	.003300	.001350	.....	.....	
6,600	33,000	.010500	.067200	.....	.....	
6,800	34,000	.011400	.000900	.....	.....	
7,000	35,000	.012400	.001000	.011200	.011100	
7,200	36,000	.014050	.001650	.....	.....	
7,400	37,000	.015400	.001350	.....	.....	
7,600	38,000	.016800	.001400	.....	.....	
7,800	39,000	.018400	.001600	.....	.....	
8,000	40,000	.020000	.001600	.018600	.007400	
8,400	42,000	.0250	.0050	.....	.....	
8,800	44,000	.0300	.0050	.....	.....	
9,200	46,000	.0375	.0075	.....	.....	
9,600	48,000	.0425	.0050	.....	.....	
10,000	50,000	.0475	.0050	.....	.....	
10,400	52,000	.0525	.0050	.....	.....	
10,800	54,000	.0575	.0050	.....	.....	
11,200	56,000	.0650	.0075	.....	.....	
11,520	57,600	.....	.....	.....	.....	Tensile strength,

General Summary.

Tensile strength, per square inch of original section.....pounds.. 57,600
Elastic limit, per square inch of original section.....do.... 30,000
Elongation per inch after rupture.....inch.. .085
Elongation per inch under strain at elastic limit.....do.... .001100
Reduction in diameter at point of rupture.....do.... .025
Reduction in area after rupture, per centum of original section..... 9.5
Position of rupture.....″.10 from the neck
Character of broken surface....granular, spongy spot at the circumference. Opened cracks in the surface of stem.
Elongation of inch sections.....″.09 ″.08

No. 4495.

Mark, B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	.....	0.	Initial load.
1,000	5,000	.000100	.000100	.....	.....	
2,000	10.000	.000250	.000150	.....	.....	
3,000	15,000	.000450	.000200	0.	.....	
4,000	20,000	.000650	.000200	.....	.....	
5,000	25,000	.000800	.000150	0.	.....	
6,000	30,000	.000950	.000150	0.	.....	
7,000	35,000	.001150	.000200	0.	.....	
8,000	40,000	.001300	.000150	.....	.....	
8,200	41,000	.001350	.000050	.....	.....	
8,400	42,000	.001400	.000050	.....	.....	
8,600	43,000	.001450	.000050	.....	.....	
8,800	44,000	.001500	.000050	.....	.....	
9,000	45,000	.001550	.000050	.....	.....	
9,200	46,000	.001650	.000100	.....	.....	Elastic limit.
9,400	47,000	.001850	.000200	.....	.....	
9,600	48,000	.002050	.000200	.....	.....	
9,800	49,000	.002200	.000150	.....	.....	
10,000	50,000	.002400	.000200	.....	.....	
10,200	51,000	.002550	.000150	.....	.....	
10,400	52,000	.002700	.000150	.....	.....	
10,600	53,000	.003050	.000350	.....	.....	
10,800	54,000	.003400	.000350	.....	.....	
11,000	55,000	.003700	.000300	.....	.....	
11,200	56,000	.003850	.000150	.....	.....	
11,400	57,000	.004100	.000250	.....	.....	
11,600	58,000	.004500	.000400	.....	.....	
11,800	59,000	.004900	.000400	.....	.....	
12,000	60,000	.005350	.000450	.....	.....	
12,800	64,000	.0100	.004650	.....	.....	
13,600	68,000	.0125	.0025	.....	.....	
14,310	71,550	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	71,550
Elastic limit per square inch of original section	do	46,000
Elongation per inch after rupture	inch	.0150
Elongation per inch under strain at elastic limit	do	.001650
Reduction in diameter at point of rupture	do	.005
Reduction in area after rupture, per centum of original section		1.8
Position of rupture		″7 from the neck
Character of broken surface		granular
Elongation of inch sections		″.02, ″.01

No. 4496.

Mark, C.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	.....	.....	
2,000	10,000	.000350	.000250	.....	.....	
3,000	15,000	.000550	.000200	.....	.....	
4,000	20,000	.000800	.000250	0.	.....	
5,000	25,000	.001100	.000300	.....	.....	
5,600	28,000	.001500	.000400	.....	.....	
5,800	29,000	.001600	.000100	.....	.....	Elastic limit.
6,000	30,000	.001900	.000300	.000850	.000850	
6,200	31,000	.002400	.000500	.....	.....	
6,400	32,000	.002700	.000300	.....	.....	
6,600	33,000	.003200	.000500	.....	.....	
6,800	34,000	.003900	.000700	.....	.....	
7,000	35,000	.004550	.000650	.003150	.002300	
7,200	36,000	.005400	.000850	.....	.....	
7,400	37,000	.005900	.000500	.....	.....	
7,600	38,000	.006650	.000750	.....	.....	
7,800	39,000	.007550	.000900	.....	.....	
8,000	40,000	.008550	.001000	.007050	.003900	
8,200	41,000	.009000	.000450	.....	.....	
8,400	42,000	.010300	.001300	.....	.....	
8,600	43,000	.011400	.001100	.....	.....	
8,800	44,000	.012450	.001050	.....	.....	
9,000	45,000	.013600	.001150	.011900	.004850	
9,200	46,000	.014450	.000850	.....	.....	
9,400	47,000	.015500	.001050	.....	.....	
9,600	48,000	.016900	.001400	.....	.....	
9,800	49,000	.018100	.001200	.....	.....	
10,000	50,000	.019500	.001400	.....	.....	
10,400	52,000	.0200	.0005	.....	.....	
10,800	54,000	.0250	.0050	.....	.....	
11,200	56,000	.0300	.0050	.....	.....	
11,600	58,000	.0350	.0050	.....	.....	
12,000	60,000	.0400	.0050	.....	.....	
12,400	62,000	.0450	.0050	.....	.....	
12,800	64,000	.0500	.0050	.....	.....	
13,100	65,500	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	65,500
Elastic limit per square inch of original section	do....	29,000
Elongation per inch after rupture	inch..	.0500
Elongation per inch under strain at elastic limit	do....	.001600
Reduction in diameter at point of rupture	do....	.015
Reduction in area after rupture, per centum of original section		5.7
Position of rupture		″.85 from the neck
Character of broken surface		granular, 20 per cent of surface dark colored
Elongation of inch sections		″.04, ″.06*

No. 936.

Mark, A.
Length, 5″.
Diameter, ″.798.
Sectional area, 50 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	0.	0.	Initial load.
2,500	5,000	.000125	.000125	0.	.....	
5,000	10,000	.000250	.000125	0.	.....	
7,500	15,000	.000375	.000125	.....	.....	
10,000	20,000	.000525	.000150	.000025	.000025	
12,500	25,000	.000700	.000175	.000050	.000025	
14,000	28,000	.000750	.000050	.....	.....	Elastic limit.
14,500	29,000	.001250	.000500	.....	.....	
15,000	30,000	.007200	.005950	.....	.....	
15,500	31,000	.008375	.001175	.....	.....	
16,000	32,000	.009575	.001200	.....	.....	
16,500	33,000	.010500	.000925	.....	.....	
17,000	34,000	.011350	.000850	.....	.....	
17,500	35,000	.012025	.000650	.....	.....	
18,000	36,000	.013025	.001000	.....	.....	
18,500	37,000	.014225	.001200	.....	.....	
19,000	38,000	.015225	.001000	.....	.....	
19,500	39,000	.016125	.000900	.....	.....	
20,000	40,000	.017000	.000875	.....	.....	
29,540	59,080	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 937.

Mark, B.
Length, 5″.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	0.	0.	Initial load.
2,500	5,000	.000125	.000125	.....	.....	
5,000	10,000	.000300	.000175	.....	.....	
7,500	15,000	.000425	.000125	.....	.....	
10,000	20,000	.000600	.000175	0.	.....	
12,500	25,000	.000775	.000175	.....	.....	
15,000	30,000	.000925	.000150	.000025	.000025	
15,500	31,000	.000950	.000025	.....	.....	
16,000	32,000	.001000	.000050	.....	.....	
16,500	33,000	.001050	.000050	.....	.....	
17,000	34,000	.001075	.000025	.....	.....	
17,500	35,000	.001125	.000050	.000050	.000025	
18,000	36,000	.001175	.000050	.....	.....	
18,500	37,000	.001200	.000025	.....	.....	
19,000	38,000	.001250	.000050	.....	.....	
19,500	39,000	.001275	.000025	.....	.....	
20,000	40,000	.001325	.000050	.000100	.000050	
20,500	41,000	.001425	.000100	.....	.....	
21,000	42,000	.001475	.000050	.....	.....	
21,500	43,000	.001550	.000075	.....	.....	
22,000	44,000	.001625	.000075	.....	.....	Elastic limit.
22,500	45,000	.001800	.000175	.000375	.000275	
23,000	46,000	.002050	.000250	.....	.....	
23,500	47,000	.002425	.000375	.....	.....	
24,000	48,000	.003375	.000950	.....	.....	
24,500	49,000	.003925	.000550	.....	.....	
25,000	50,000	.004275	.000350	.002600	.002225	
25,500	51,000	.004700	.000425	.....	.....	
26,000	52,000	.005050	.000350	.....	.....	
26,500	53,000	.005550	.000500	.....	.....	
27,000	54,000	.006000	.000450	.....	.....	
27,500	55,000	.006450	.000450	.004575	.001975	
28,000	56,000	.006850	.000400	.....	.....	
28,500	57,000	.007250	.000400	.....	.....	
29,000	58,000	.007700	.000450	.....	.....	
29,500	59,000	.008250	.000550	.....	.....	
30,000	60,000	.008575	.000325	.006525	.001950	
52,900	105,800	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 938.

Mark, C.
Length, 5″.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	0.	0.	Initial load.
2,500	5,000	.000150	.000150	.....	.....	
5,000	10,000	.000325	.000175	.....	.....	
7,500	15,000	.000500	.000175	.....	.....	
10,000	20,000	.000650	.000150	.000025	.000025	
12,500	25,000	.000875	.000225	.000100	.000075	
13,000	26,000	.000950	.000075	.....	.....	
13,500	27,000	.001000	.000050	.....	.....	Elastic limit.
14,000	28,000	.001152	.000125	.....	.....	
14,500	29,000	.001250	.000125	.....	.....	
15,000	30,000	.001475	.000225	.000500	.000400	
15,500	31,000	.002175	.000700	.....	.....	
16,000	32,000	.003225	.001050	.....	.....	
16,500	33,000	.004325	.001100	.....	.....	
17,000	34,000	.005375	.001050	.....	.....	
17,500	35,000	.006200	.000825	.004925	.004425	
18,000	36,000	.006750	.000550	.....	.....	
18,500	37,000	.007500	.000750	.....	.....	
19,000	38,000	.008500	.001000	.....	.....	
19,500	39,000	.009250	.000750	.....	.....	
20,000	40,000	.010000	.000750	.008500	.003575	
20,500	41,000	.010575	.000575	.....	.....	
21,000	42,000	.011325	.000750	.....	.....	
21,500	43,000	.012125	.000800	.....	.....	
22,000	44,000	.013175	.001050	.....	.....	
22,500	45,000	.013975	.000800	.012250	.003750	
23,000	46,000	.014575	.000600	.....	.....	
23,500	47,000	.015500	.000925	.....	.....	
24,000	48,000	.016725	.001225	.....	.....	
24,500	49,000	.017500	.000775	.....	.....	
25,000	50,000	.018375	.000875	.016450	.004200	
36,310	72,620	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

CAST IRON AND PIG IRON.

CAST IRON.

No. of test.	Description and marks.	Diameter.	Sectional area.	Tensile strength per square inch.
		Inches.	*Sq. inch.*	*Pounds.*
4360	Remelted 12″ Dyer projectiles. From Watertown Arsenal Foundry.	1.129	1.00	21,750
4361		1.129	1.00	20 600
4385	12 M Sh H_2 B L_1	1.129	1.00	26,980
4386	8″ R S	1.129	1.00	12,370
4387	12 M Sh H_3	1.129	1.00	26,100
4374		1.129	1.00	25,570
4341	Fractured pintle plate of 12″ carriage	1.129	1.00	10,740
4342	……do	1.129	1.00	14,360
4372	Broken part of Easton and Anderson carriage	1.129	1.00	25,870
4373		1.129	1.00	26,340

MUIRKIRK PIG IRON.

4343	First pig	1.129	1.00	29,200
4344	Second pig	1.129	1.00	24,740
4358	Third pig	1.129	1.00	30,020
4359	Fourth pig	1.129	1.00	28,780

CAST IRON FROM 12-INCH SHOT, CAST AT WATERVLIET ARSENAL.

No. 4350.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0..	0.	Initial load.
500	2,000	.000033	.000033	.....	.....	
750	3,000	.000117	.000084	.....	.....	
1,000	4,000	.000167	.000050	.....	.....	
1,250	5,000	.000200	.000033	0.	.....	
1,500	6,000	.000267	.000067	.....	.....	
1,750	7,000	.000333	.000066	.....	.....	
2,000	8,000	.000433	.000100	.....	.....	
2,250	9,000	.000500	.000067	.....	.....	
2,500	10,000	.000600	.000100	0.	.....	
2,750	11,000	.000650	.000050	.....	.....	
3,000	12,000	.000717	.000067	.....	.....	
3,250	13,000	.000800	.000083	.....	.....	
3,500	14,000	.000883	.000083	.000017	.000017	
3,750	15,000	.000967	.000084	.....	.....	
4,000	16,000	.001067	.000100	.....	.....	
4,250	17,000	.001167	.000100	.....	.....	
4,500	18,000	.001300	.000133	.000067	.000050	
4,750	19,000	.001400	.000100	.....	.....	
5,000	20,000	.001500	.000100	.....	.....	
5,250	21,000	.001567	.000067	.....	.....	
5,500	22,000	.001733	.000166	.000217	.000150	
5,750	23,000	.001867	.000134	.....	.....	
6,000	24,000	.002033	.000166	.....	.....	
6,250	25,000	.002200	.000167	.000450	.000233	
6,500	26,000	.002433	.000233	.....	.....	
6,750	27,000	.002600	.000167	.....	.....	
7,000	28,000	.002867	.000267	.....	.....	
7,250	29,000	.003150	.000283	.....	.....	
7,500	30,000	.003683	.000533	.001350	.000900	
7,760	31,040	.....	.....	.....	.....	Tensile strength.

Fractured 2″ from the neck. Appearance, fine granular.

No. 4351.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
500	2,000	.000033	.000033	.....	.....	
750	3,000	.000150	.000117	.....	.....	
1,000	4,000	.000183	.000033	.....	.....	
1,250	5,000	.000217	.000034	0.	.....	
1,500	6,000	.000300	.000083	.....	.....	
1,750	7,000	.000350	.000050	.....	.....	
2,000	8,000	.000450	.000100	.....	.....	
2,250	9,000	.000517	.000067	.....	.....	
2,500	10,000	.000600	.000083	0.	.....	
2,750	11,000	.000667	.000067	.....	.....	
3,000	12,000	.000750	.000083	.....	.....	
3,250	13,000	.000833	.000083	.....	.....	
3,500	14,000	.000917	.000084	.000033	.000033	
3,750	15,000	.000983	.000066	.....	.....	
4,000	16,000	.001100	.000117	.....	.....	
4,250	17,000	.001183	.000083	.....	.....	
4,500	18,000	.001300	.000117	.000133	.000100	
4,750	19,000	.001383	.000083	.....	.....	
5,000	20,000	.001517	.000134	.....	.....	
5,250	21,000	.001600	.000083	.....	.....	
5,500	22,000	.001767	.000167	.000267	.000134	
5,750	23,000	.001867	.000100	.....	.....	
6,000	24,000	.002033	.000166	.....	.....	
6,250	25,000	.002200	.000167	.000467	.000200	
6,500	26,000	.002467	.000267	.....	.....	
6,750	27,000	.002650	.000183	.....	.....	
7,000	28,000	.003017	.000367	.....	.....	
7,250	29,000	.003250	.000233	.....	.....	
7,500	30,000	.003850	.000600	.....	.....	Tensile strength.

Fractured 2″.3 from the neck. Appearance, fine granular.

No. 903.

Length, 6″.
Diameter, ″.999.
Sectional area, .785 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
785	1,000	0.	0.	0.	0.	Initial load.
3,925	5,000	.600250	.000250	0.	.....	
7,850	10,000	.000550	.000300	0.	.....	
11,775	15,000	.000800	.000250	.000025	.000025	
12,560	16,000	.000900	.000100	.....	.....	
13,345	17,000	.000950	.000050	.....	.....	
14,130	18,000	.001000	.000050	.....	.....	
14,915	19,000	.001100	.000100	.....	.....	
15,700	20,000	.001125	.000025	.000050	.000025	
16,485	21,000	.001200	.000075	.....	.....	
17,270	22,000	.001250	.000050	.....	.....	
18,055	23,000	.001300	.000050	.....	.....	
18,840	24,000	.001400	.000100	.....	.....	
19,625	25,000	.001450	.000050	.000075	.000025	
20,410	26,000	.001550	.000100	.....	.....	
21,195	27,000	.001625	.000075	.....	.....	
21,980	28,000	.001675	.000050	.....	.....	
22,765	29,000	.001725	.000050	.....	.....	
23,550	30,000	.001825	.000100	.000175	.000100	
24,335	31,000	.001900	.000075	.....	.....	
25,120	32,000	.001950	.000050	.....	.....	
25,905	33,000	.002050	.000100	.....	.....	
26,690	34,000	.002150	.000100	.....	.....	
27,475	35,000	.002225	.000075	.000200	.000025	
28,260	36,000	.002275	.000050	.....	.....	
29,045	37,000	.002325	.000050	.....	.....	
29,830	38,000	.002375	.000050	.....	.....	
30,615	39,000	.002500	.000125	.....	.....	
31,400	40,000	.002625	.000125	.000375	.000175	
32,185	41,000	.002750	.000125	.....	.....	
32,970	42,000	.002875	.000125	.....	.....	
33,755	43,000	.003000	.000125	.....	.....	
34,540	44,000	.003150	.000150	.....	.....	
35,325	45,000	.003275	.000125	.000825	.000450	
36,110	46,000	.003500	.000225	.....	.....	
36,895	47,000	.003725	.000225	.....	.....	
37,680	48,000	.003950	.000225	.....	.....	
38,465	49,000	.004200	.000250	.....	.....	
39,250	50,000	.004400	.000200	.001600	.000775	
40,820	52,000	.004825	.000425	.....	.....	
42,390	54,000	.005450	.000625	.....	.....	
43,960	56,000	.005875	.000425	.....	.....	
45,530	58,000	.006375	.000500	.....	.....	
47,100	60,000	.007125	.000750	.003625	.002025	
48,670	62,000	.007650	.000525	.....	.....	
50,240	64,000	.008575	.000925	.....	.....	
51,810	66,000	.009525	.000950	.....	.....	
53,380	68,000	.010700	.001175	.....	.....	
54,950	70,000	.011750	.001050	.007575	.003950	
56,520	72,000	.012250	.000500	.....	.....	
58,090	74,000	.012750	.000500	.....	.....	
59,660	76,000	.013975	.001225	.....	.....	
61,230	78,000	.015000	.001025	.....	.....	
62,800	80,000	.016275	.001275	.011325	.003750	
77,650	98,930	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

Oblique shearing cracks developed on the compression side of the bend; tensile fractures started on the convex side.

No. 904.

Length, 6″.
Diameter, ″.999.
Sectional area, .785 square inch.
Gauged length, 4″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
785	1,000	0.	0.	0.	0.	Initial load.
3,925	5,000	.000200	.000200	0.	.....	
7,850	10,000	.000500	.000300	0.	.....	
11,775	15,000	.000625	.000125	—.000125	—.000125	
15,700	20,000	.000750	.000125	—.000300	—.000175	
19,625	25,000	.001000	.000250	—.000475	—.000175	
23,550	30,000	.001025	.000025	—.000750	—.000275	
Specimen readjusted in machine, and micrometer reset.						
785	1,000	0.	0.	0.	0.	Initial load.
3,925	5,000	.000200	.000200	.....	.....	
7,850	10,000	.000500	.000300	.....	.....	
11,775	15,000	.000800	.000300	.....	.....	
15,700	20,000	.001075	.000275	.....	.....	
19,625	25,000	.001100	.000025	.....	.....	
23,550	30,000	.000875	—.000225	—.000750	—.000750	
27,475	35,000	.001200	+.000325	—.000775	—.000025	
31,400	40,000	.001300	.000100	—.000925	—.000150	
35,325	45,000	.002150	.000850	—.000375	+.000550	
39,250	50,000	.002950	.000800	+.000125	.000500	
47,100	60,000	.006750	.003800	.002900	.002775	
54,950	70,000	.011900	.005150	.007550	.004650	
62,800	80,000	.018375	.006475	.013100	.005550	
76,800	97,830	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure.

This specimen when first placed in the testing machine was carefully adjusted, so that the pressure was uniformly received at the ends. It developed a tendency to deflect convex on the micrometer side, resulting in the display of minus sets.

After 30,000 pounds per square inch had been applied the specimen was readjusted and the micrometer reset to zero. The minus sets continued to appear until after 45,000 pounds per square inch had been applied, after passing which load the sets were in a plus direction.

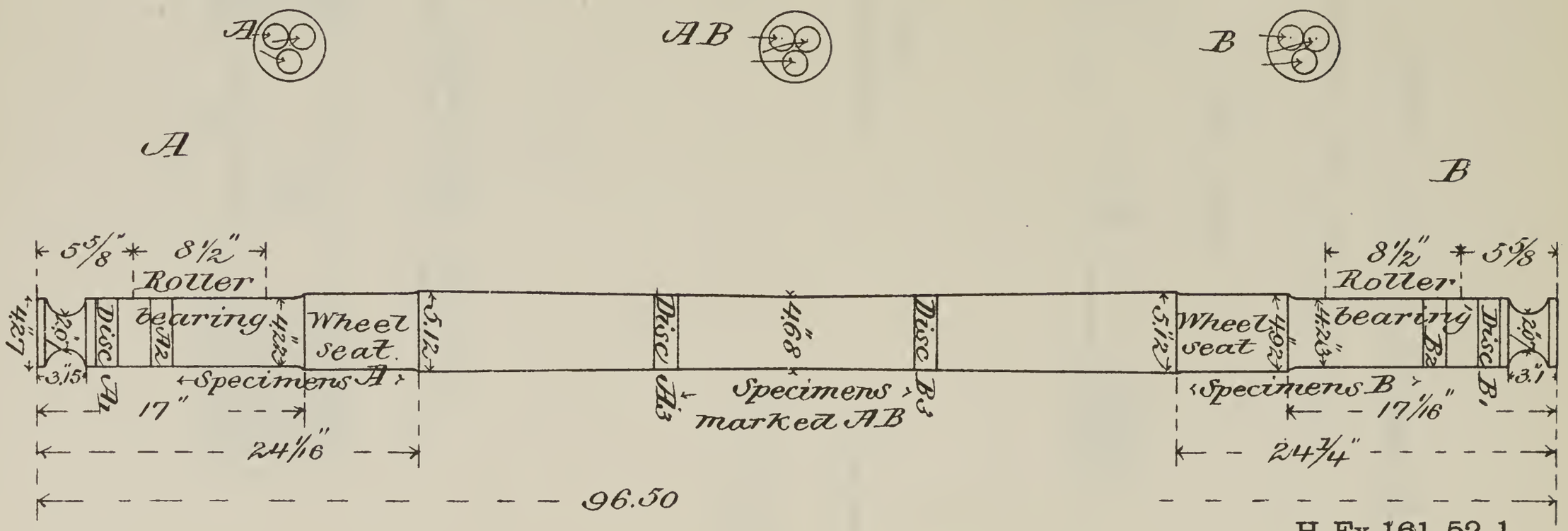
STEEL RAILWAY AXLE

WITH

ROLLER JOURNAL BEARINGS.

Steel axle, with roller journal bearings.

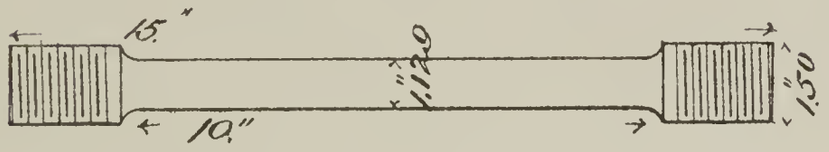
Branded "Troy S&I Co. 1888 B".



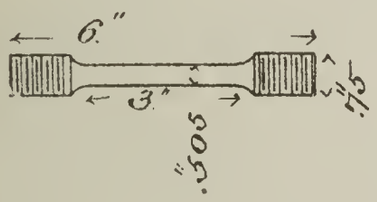
Steel axle, with roller journal bearings.

Forms of specimens.

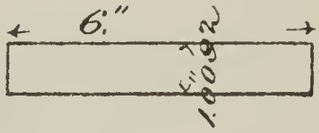
Tension.



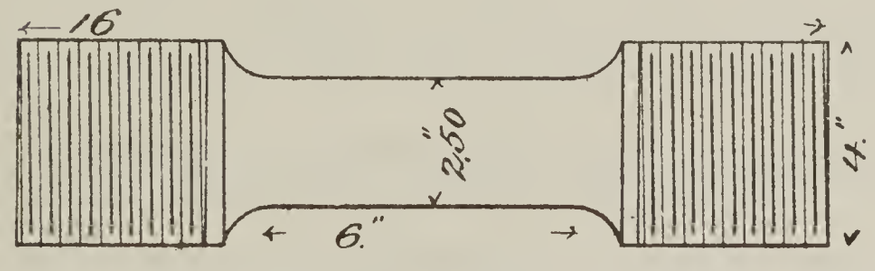
Tension taken from compression specimen



Compression.



For alternate stresses, tension and compression.



H Ex 161 52 1

This axle had been in passenger service, and had run about 100,000 miles when taken out for testing.

The chemical composition of the metal was as follows:

	Per cent.
Carbon combined	.138
Carbon graphitic	.018
Total	.156
Manganese	.834
Silicon	.006
Sulphur	.115
Phosphorus	.092
Copper	.305

The metal was examined for internal strains. Six disks were taken, three from each end of the axle, and rings $\frac{1}{4}''$ thick cut from the outside of the disk. When detached from its disk each ring expanded, thus showing it had been in an initial state of compression, the magnitude of the stresses being from 6,259 to 7,526 pounds per square inch.

Of the three disks from end A, the greatest internal strains belonged to that taken from the section covered by the roller bearing. At end B, however, the corresponding disk showed the least strains of the three. It is not apparent from this evidence that any change in internal strains had been caused by the direct compressive action of the roller bearings.

Three tensile specimens were taken from each end, covering a section which comprised parts of the wheel seat and of the journal; also three specimens came from the middle of its length.

In respect to its tensile properties, the metal had apparently been undisturbed by the service it had seen.

The observations were extended so as to include alternate stresses of tension and compression. After rupture by tension the longer ends of the stems of three specimens were turned cylindrical with flat ends and then tested by compression, after which they were again turned down to tensile form and retested by tension.

The fact will be noted that when loaded by compression, after rupture by tension, the metal possessed a higher elastic limit than previously found in the tensile test, and further that under retest by tension, while a sharply defined elastic limit was not found, yet a very high stress was received before any permanent set was detected.

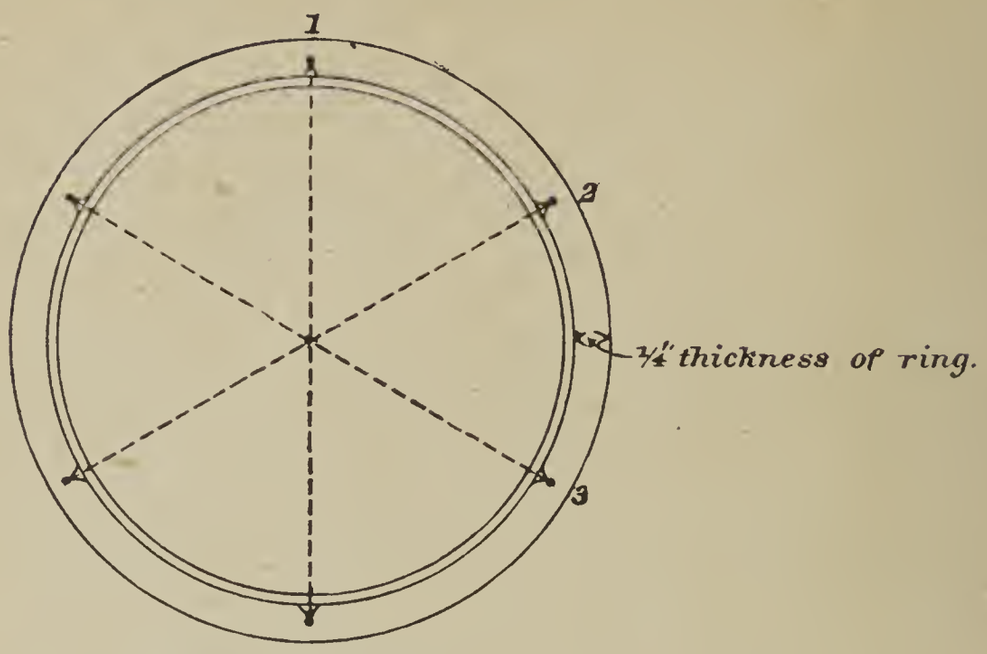
The metal in this axle differs in respect to the effect of overloading upon its opposite elastic limit from results with another grade of steel, in which latter case permanent sets appeared under loads much below the primitive elastic limit.

That this axle metal originally possessed about the same elastic limit in tension as in compression is shown by the tests of the additional specimens taken from the section between the wheel seat and disk A_3.

When finally ruptured the retested tensile specimens showed higher strength with limited elongation, except in the contracted section at the place of rupture.

For further examination by alterstresses a specimen has been prepared having 2.5 inches diameter of stem by 6 inches long, which awaits testing.

TEST OF DISKS FOR INTERNAL STRAINS.



Length of discs 1″.

No. of test.	Disk.	Diameters.	Diameters of rings.		Difference in diameters.		Corresponding compression stress per square inch.
			Before detached.	After detached.	Total.	Mean.	
			Inches.	*Inches.*	*Inch.*	*Inch.*	*Pounds.*
4375	A_1	1	3.9734	3.9738	.0004		
		2	3.9757	3.9772	.0015	.00083	6,259
		3	3.9753	3.9759	.0006		
4376	A_2	1	3.9844	3.9858	.0014		
		2	3.9743	3.9747	.0004	.00093	7,006
		3	3.9877	3.9887	.0010		
4377	A_3	1	4.4726	4.4741	.0015		
		2	4.4770	4.4771	.0001	.00083	5,568
		3	4.4671	4.4680	.0009		
4378	B_1	1	3.9907	3.9922	.0015		
		2	3.9863	3.9874	.0011	.00100	7,526
		3	3.9813	3.9817	.0004		
4379	B_2	1	3.9936	3.9967	.0001		
		2	3.9871	3.9896	.0025	.00090	6,764
		3	3.9936	3.9937	.0001		
4380	B_3	1	4.4809	4.4823	.0014		
		2	4.4846	4.4848	.0002	.00103	6,892
		3	4.4846	4.4861	.0015		

No. 4651.

Mark, A.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0011	.....	
10,000	10,000	.0028	.....	
15,000	15,000	.0045	—.0001	
20,000	20,000	.0061	.....	
25,000	25,000	.0079	.....	
30,000	30,000	.0100	.0002	
31,000	31,000	.0108	.....	
32,000	32,000	.0115	.....	
33,000	33,000	.0125	.....	Elastic limit.
34,000	34,000	.0670	.....	
35,000	35,000	.1000	.0889	
36,000	36,000	.1220	.....	
37,000	37,000	.1440	.....	
38,000	38,000	.1612	.....	
39,000	39,000	.1787	.....	
40,000	40,000	.1870	.....	
42,000	42,000	.26	.....	
44,000	44,000	.30	.....	
46,000	46,000	.35	.....	
48,000	48,000	.42	.....	
50,000	50,000	.47	.....	
52,000	52,000	.54	.....	
54,000	54,000	.63	.....	
56,000	56,000	.76	.....	
58,000	58,000	.89	.....	
60,000	60,000	1.12	.....	
62,000	62,000	1.44	.....	
63,340	63,340	2.12	.....	Tensile strength.
0	0	2.70	.....	= 2.7 per cent.

Elongation of inch sections: ″.13, ″.20, ″.21, ″.23, ″.21, ″.24, ″.40, ″.62,* ″.27, ″.19.

Diameter at fracture, ″.75. Area, ″.442 square inch.

Contraction of area, 55.8 per cent.

Fracture occurred in that section of the axle under the wheel seat, and about 1 inch from the inner end of the journal. Appearance of fracture, fine silky.

No. 4652.

Mark, A.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0013	.....	
10,000	10,000	.0032	.....	
15,000	15,000	.0048	0.	
20,000	20,000	.0065	.....	
25,000	25,000	.0081	.....	
30,000	30,000	.0103	.0006	Elastic limit.
31,000	31,000	.0117	.....	
32,000	32,000	.0132	.....	
33,000	33,000	.0550	.....	
34,000	34,000	.0710	.....	
35,000	35,000	.1050	.0927	
36,000	36,000	.1192	.....	
37,000	37,000	.1358	.....	
38,000	38,000	.1530	.....	
39,000	39,000	.1745	.....	
40,000	40,000	.1890	.....	
42,000	42,000	.24	.....	
46,000	46,000	.36	.....	
48,000	48,000	.42	.....	
50,000	50,000	.48	.....	
52,000	52,000	.57	.....	
54,000	54,000	.65	.....	
56,000	56,000	.77	.....	
58,000	58,000	.92	.....	
60,000	60,000	1.13	.....	
62,000	62,000	1.52	.....	
62,710	62,710	2.01	.....	Tensile strength.
0	0	2.66	.....	=26.6 per cent.

Elongation of inch sections: ″.13, ″.17, ″.20, ″.23, ″.22, ″.24, ″.30, ″.68*, ″.31, ″.18.

Diameter at fracture, ″.76. Area, .454 square inch.

Contraction of area, 54.6 per cent.

Fractures in that section of axle under the wheel seat and about 1 inch from inner end of journal. Appearance of fracture, fine, silky.

COMPRESSION TEST OF SPECIMEN TAKEN FROM THE END OF FRACTURED TENSILE SPECIMEN.

No. 4652*a*.

Length, 6″.
Diameter, ″.991.
Sectional area, .771 square inch.
Gauged length, 4″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
771	1,000	0.	0.	Initial load.
3,855	5,000	.0003	0.	
7,710	10,000	.0008	0.	
11,565	15,000	.0013	0.	
15,420	20,000	.0019	0.	
19,275	25,000	.0025	—.0002	
20,046	26,000	.0026	.....	
20,817	27,000	.0027	.....	
21,588	28,000	.0027	.....	
22,359	29,000	.0029	.....	
23,130	30,000	.0030	—.0003	
23,901	31,000	.0031	.....	
24,672	32,000	.0033	.....	
25,443	33,000	.0034	.....	
26,214	34,000	.0035	.....	
26,985	35,000	.0037	—.0003	
27,756	36,000	.0039	.....	
28,527	37,000	.0040	.....	
29,298	38,000	.0041	.....	
30,069	39,000	.0042	.....	
30,840	40,000	.0044	—.0003	
31,611	41,000	.0046	.....	
32,382	42,000	.0048	.....	
33,153	43,600	.0050	.....	
33,924	44,000	.0051	.....	
34,695	45,000	.0053	—.0001	
35,466	46,000	.0055	.....	
36,237	47,000	.0057	.....	
37,008	48,000	.0060	.....	
37,779	49,000	.0062	.....	Elastic limit.
38,550	50,000	.0065	.0004	
39,321	51,000	.0069	.....	
40,092	52,000	.0072	.....	
40,863	53,000	.0077	.....	
41,634	54,000	.0080	.....	
42,405	55,000	.0087	.0018	
43,176	56,000	.0095	.....	
43,947	57,000	.0100	.....	
44,718	58,000	.0108	.....	
45,489	59,000	.0116	.....	
46,260	60,000	.0128	.0050	Rested under 30,000 pounds per square inch three hours.
47,031	61,000	.0131	.....	
47,802	62,000	.0137	.....	
48,573	63,000	.0169	.....	
49,344	64,000	.0191	.....	
50,115	65,000	.0212	.0127	

Compression test discontinued.
Specimen turned down for test by tension.

TENSION TEST OF SPECIMEN TAKEN FROM COMPRESSION SPECIMEN.

No. 4652*b*.

Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0002	0.	
2,000	10,000	.0009	0.	
3,000	15,000	.0013	0.	
4,000	20,000	.0017	0.	
5,000	25,000	.0022	0.	
6,000	30,000	.0029	0.	
7,000	35,000	.0033	0.	
8,000	40,000	.0039	0.	
9,000	45,000	.0043	0.	
9,200	46,000	.0044	.....	
9,400	47,000	.0045	.....	
9,600	48,000	.0046	.....	
9,800	49,000	.0048	.....	
10,000	50,000	.0049	.0001	
10,200	51,000	.0051	.....	
10,400	52,000	.0052	.....	
10,600	53,000	.0053	.....	
10,800	54,000	.0054	.....	
11,000	55,000	.0055	.0002	
11,200	56,000	.0056	.....	
11,400	57,000	.0057	.....	
11,600	58,000	.0059	.....	
11,800	59,000	.0061	.....	
12,000	60,000	.0063	.0003	
12,200	61,000	.0065	.....	
12,400	62,000	.0067	.....	
12,600	63,000	.0068	.....	
12,800	64,000	.0070	.....	
13,000	65,000	.0073	.0009	
13,200	66,000	.0076	.....	
13,400	67,000	.0078	.....	
13,600	68,000	.0080	.....	
13,800	69,000	.0082	.....	
14,000	70,000	.0086	.0014	
14,200	71,000	.0090	.....	
14,400	72,000	.0092	.....	
14,600	73,000	.0097	.....	
14,800	74,000	.0101	.....	
15,000	75,000	.0108	.0030	
15,200	76,000	.0112	.....	
15,400	77,000	.0118	.....	
15,600	78,000	.0128	.....	
15,800	79,000	.0132	.....	
16,000	80,000	.0141	.0059	
16,200	81,000	.0151	.....	
16,400	82,000	.0161	.....	
16,600	83,000	.0176	.....	
16,800	84,000	.0193	.....	
17,000	85,000	.0237	.0142	
17,200	86,000	.07	.....	
17,240	86,200	.....	.....	Tensile strength.
13,400	.....	.....	.....	Load at time of rupture.
0	0	.27	.....	=9 per cent.

Elongation of inch sections: ″.24*, ″.02, ″.01.
Diameter at fracture, ″.37. Area, .108 square inch.
Contraction of area, 46 per cent.
Fractured ″.7 from the neck. Appearance, fine silky.

No. 4653.

Mark, A.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0010	.....	
10,000	10,000	.0025	.....	
15,000	15,000	.0042	0.	
20,000	20,000	.0060	.....	
25,000	25,000	.0078	0.	
28,000	28,000	.0089	.....	
29,000	29,000	.0094	.....	
30,000	30,000	.0099	0.	
31,000	31,000	.0104	.....	
32,000	32,000	.0109	.....	Elastic limit.
33,000	33,000	.0398	.....	
34,000	34,000	.0820	.....	
35,000	35,000	.1103	.0982	
36,000	36,000	.1240	.....	
37,000	37,000	.1450	.....	
38,000	38,000	.1612	.....	
39,000	39,000	.1775	.....	
40,000	40,000	.2000	.....	
42,000	42,000	.24	.....	
44,000	44,000	.30	.....	
46,000	46,000	.36	.....	
48,000	48,000	.42	.....	
50,000	50,000	.50	.....	
52,000	52,000	.57	.....	
54,000	54,000	.67	.....	
56,000	56,000	.80	.....	
58,000	58,000	.96	.....	
60,000	60,000	1.19	.....	
62,000	62,000	1.53	.....	
62,980	62,980	2.04	.....	Tensile strength.
0	0	2.72	.....	=27.2 per cent.

Elongation of inch sections: ″.15, ″.20, ″.23, ″.25, ″.27, ″.64,* ″.35, ″.23, ″.22, ″.18.

Diameter at fracture, ″.75. Area, .442 square inch.

Contraction of area, 55.8 per cent.

Fracture occurred at a point in the journal 1 inch from the neck at its inner end. Appearance of fracture, fine silky.

No. 4654.

Marks, A B.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0015	.....	
10,000	10,000	.0031	.....	
15,000	15,000	.0049	0.	
20,000	20,000	.0066	.....	
25,000	25,000	.0081	0.	
28,000	28,000	.0091	.....	
29,000	29,000	.0096	.....	
30,000	30,000	.0100	0.	
31,000	31,000	.0103	.....	
32,000	32,000	.0107	.....	
33,000	33,000	.0111	.....	
34,000	34,000	.0116	.....	
35,000	35,000	.0121	.0003	Elastic limit.
36,000	36,000	.0350	.....	
37,000	37,000	.0770	.....	
38,000	38,000	.1336	.....	Rested 30 minutes under load.
39,000	39,000	.1400	.....	
40,000	40,000	.1580	.....	
42,000	42,000	.22	.....	
44,000	44,000	.26	.....	
46,000	46,000	.32	.....	
48,000	48,000	.38	.....	
50,000	50,000	.45	.....	
52,000	52,000	.53	.....	
54,000	54,000	.61	.....	
56,000	56,000	.73	.....	
58,000	58,000	.88	.....	
60,000	60,000	1.06	.....	
62,000	62,000	1.38	.....	
63,120	63,120	1.90	.....	Tensile strength.
0	0	2.24	.....	= 24.4 per cent.

Elongation of inch sections: ″.15, ″.19, ″.19, ″.20, ″.20, ″.20, ″.29, ″.45*, ″.21, ″.16.

Diameter at fracture, ″.89. Area, .622 square inch.

Contraction of area, 37.8 per cent.

Appearance of fracture, silky, oblique. Opened cracks in cylindrical surface of stem in vicinity of fracture.

No. 4655.

Marks, A. B.
Diameter, 1.″129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0012	.....	
10,000	10,000	.0030	.....	
15,000	15,000	.0048	0.	
20,000	20,000	.0065	.....	
25,000	25,000	.0082	.....	
30,000	30,000	.0100	0.	
31,000	31,000	.0105	.....	
32,000	32,000	.0110	.....	
33,000	33,000	.0112	.....	
34,000	34,000	.0117	.....	
35,000	35,000	.0121	.0002	Elastic limit.
36,000	36,000	.0375	.....	
37,000	37,000	.0750	.....	
38,000	38,000	.1140	.....	
39,000	39,000	.1517	.....	
40,000	40,000	.1710	.....	
42,000	42,000	.21	.....	
44,000	44,000	.26	.....	
46,000	46,000	.31	.....	
48,000	48,000	.37	.....	
50,000	50,000	.42	.....	
52,000	52,000	.46	.....	
54,000	54,000	.51	.....	
56,000	56,000	.72	.....	
58,000	58,000	.86	.....	
60,000	60,000	1.08	.....	
62,000	62,000	1.38	.....	
63,100	63,100	2.07	.....	Tensile strength.
0	0	2.45	.....	=24.5 per cent.

Elongation of inch sections: ″.16, ″.17, ″.19, ″.22, ″.19, ″.19, ″38, ″.57*, ″.22, ″.16.

Diameter at fracture, ″.77. Area, .466 square inch.

Contraction of area, 53.4 per cent.

Appearance of fracture, silky with small spots of lighter colored metal. Opened slight cracks in cylindrical surface of stem.

COMPRESSION TEST OF SPECIMEN TAKEN FROM THE STEM OF FRACTURED TENSILE SPECIMEN.

No. 4655*a*.

Length, 6″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 4″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4,000	5,000	.0003	0.	
8,000	10,000	.0010	0.	
12,000	15,000	.0016	.0001	
16,000	20,000	.0021	.0001	
20,000	25,000	.0028	.0000	
24,000	30,000	.0035	.0001	
28,000	35,000	.0042	.0000	
32,000	40,000	.0048	.0001	
36,000	45,000	.0055	.0000	
36,800	46,000	.0056	.....	
37,600	47,000	.0057	.....	
38,400	48,000	.0061	.....	
39,200	49,000	.0063	.....	Elastic limit.
40,000	50,000	.0068	.0005	
40,800	51,000	.0069	.....	
41,600	52,000	.0072	.....	
42,400	53,000	.0077	.....	
43,200	54,000	.0082	.....	
44,000	55,000	.0087	.0018	
44,800	56,000	.0092	.....	
45,600	57,000	.0100	.....	
46,400	58,000	.0108	.....	
47,200	59,000	.0117	.....	
48,000	60,000	.0128	.0050	
48,800	61,000	.0139	.....	
49,600	62,000	.0152	.....	
50,400	63,000	.0166	.....	
51,200	64,000	.0185	.....	
52,000	65,000	.0208	.0122	

Compression test discontinued.
Specimen turned down and tested by tension.

TENSION TEST OF SPECIMEN TAKEN FROM COMPRESSION SPECIMEN.

No. 4655*b*.

Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0002	.....	
2,000	10,000	.0007	.....	
3,000	15,000	.0012	.....	
4,000	20,000	.0017	0.	
5,000	25,000	.0022	.....	
6,000	30,000	.0027	0.	
7,000	35,000	.0032	.....	
8,000	40,000	.0037	0.	
9,000	45,000	.0042	.....	
10,000	50,000	.0047	0.	
11,000	55,000	.0052	0.	
12,000	60,000	.0060	.0001	
12,200	61,000	.0062	.....	
12,400	62,000	.0063	.....	
12,600	63,000	.0065	.....	
12,800	64,000	.0067	.....	
13,000	65,000	.0069	.0003	
13,200	66,000	.0071	.....	
13,400	67,000	.0073	.....	
13,600	68,000	.0077	.....	
13,800	69,000	.0080	.....	
14,000	70,000	.0082	.0011	
14,200	71,000	.0086	.....	
14,400	72,000	.0092	.....	
14,600	73,000	.0096	.....	
14,800	74,000	.0099	.....	
15,000	75,000	.0102	.0027	
15,200	76,000	.0107	.....	
15,400	77,000	.0112	.....	
15,600	78,000	.0121	.....	
15,800	79,000	.0129	.....	
16,000	80,000	.0142	.0064	
16,200	81,000	.0147	.....	
16,400	82,000	.0153	.....	
16,600	83,000	.0171	.....	
16,800	84,000	.0209	.....	
17,000	85,000	.0540	.....	Tensile strength.
12,950	.....	.....	.....	Load at time of rupture.
0	0	.24	.....	= 8 per cent.

Elongation of inch sections: ″.23,* ″.01, ″.00.
Diameter at fracture, ″.37. Area, .108 square inch.
Contraction of area, 46 per cent.
Fractured ″.55 from the neck. Appearance, fine silky.

No. 4656.

Marks, A B.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0012	.....	
10,000	10,000	.0030	.....	
15,000	15,000	.0047	.....	
20,000	20,000	.0063	.....	
25,000	25,000	.0080	.....	
30,000	30,000	.0098	0.	
31,000	31,000	.0102	.....	
32,000	32,000	.0106	.....	
33,000	33,000	.0109	.....	
34,000	34,000	.0113	.....	
35,000	35,000	.0118	.0001	
36,000	36,000	.0122	.....	Elastic limit.
		.0570	.....	
37,000	37,000	.0790	.....	
38,000	38,000	.1145	.....	
39,000	39,000	.1480	.....	
40,000	40,000	.1695	.1555	Rested under initial load 15 hours.
			.1551	After resting.
39,000	39,000	.1683	.....	
40,000	40,000	.1688	.....	
41,000	41,000	.1690	.....	
42,000	42,000	.1692	.....	
43,000	43,000	.1698	.....	
44,000	44,000	.1702	.....	
44,800	44,800	.1717	.....	Rapid stretching resumed.
45,000	45,000	.1784	.....	
46,000	46,000	.2650	.....	
47,000	47,000	.3190	.....	
48,000	48,000	.34	.....	
49,000	49,000	.38	.....	
50,000	50,000	.40	.....	
52,000	52,000	.48	.....	
54,000	54,000	.58	.....	
56,000	56,000	.70	.....	
58,000	58,000	.85	.....	
60,000	60,000	1.06	.....	
62,000	62,000	1.32	.....	
63,210	63,210	1.92	.....	Tensile strength.
55,400	55,400	.....	.....	Load at time of fracture.
0	0	2.40	.....	=24 per cent.

Elongation of inch sections, ″.16, ″.19, ″.18, ″.20, ″.25, ″.52,* ″.33, ″.22, ″.19, ″.16.

Diameter at fracture, ″.85. Area, .567 square inch.

Contraction of area, 43.3 per cent.

Appearance of fracture, silky. Opened fine cracks along surface of stem. In the fractured surface, near the circumference, in line of the fine cracks developed, was a small round spot of light colored metal.

No. 4657.

Mark, B.
Diameter 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0014	.....	
10,000	10,000	.0032	.....	
15,000	15,000	.0049	.....	
20,000	20,000	.0066	.....	
25,000	25,000	.0082	0.	
30,000	30,000	.0110	.0009	Elastic limit.
31,000	31,000	.0165	.....	
32,000	32,000	.0370	.....	
33,000	33,000	.0565	.....	
34,000	34,000	.0835	.....	
35,000	35,000	.1107	.....	
36,000	36,000	.1220	.....	
37,000	37,000	.1410	.....	
38,000	38,000	.1625	.....	
39,000	39,000	.1790	.....	
40,000	40,000	.1970	.....	
42,000	42,000	.23	.....	
44,000	44,000	.29	.....	
46,000	46,000	.36	.....	
48,000	48,000	.43	.....	
50,000	50,000	.49	.....	
52,000	52,000	.61	.....	
54,000	54,000	.69	.....	
56,000	56,000	.82	.....	
58,000	58,000	1.00	.....	
60,000	60,000	1.32	.....	
60,500	60,500	1.58	.....	Tensile strength.
51,400	.....	.....	.....	Load at time of fracture.
0	0	1.64	.....	=16.4 per cent.

Elongation of inch sections: ″.13, ″.15, ″.17, ″.18, ″.31*, ″.18, ″.16, ″.12, ″.13, ″.11.

Diameter at fracture, ″.99. Area, .770 square inch.

Contraction of area, 23 per cent.

Fracture occurred in the journal part of the specimen, 1″ from the inner end of the journal. Appearance of fracture, granular 60 per cent, silky 40 per cent. The silky section contained three spots, about ″.15 diameter each, of light colored metal, which spots were in line of cracks developed in the cylindrical surface of the stem.

No. 4658.

Mark, B.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0012	.....	
10,000	10,000	.0031	.....	
15,000	15,000	.0047	.....	
20,000	20,000	.0066	.....	
25,000	25,000	.0081	0.	
28,000	28,000	.0097	.....	
29,000	29,000	.0101	.....	
30,000	30,000	.0110	.0009	Elastic limit.
31,000	31,000	.0198	.....	
32,000	32,000	.0375	.....	
33,000	33,000	.0565	.....	
34,000	34,000	.0840	.....	
35,000	35,000	.1060	.....	
36,000	36,000	.1210	.....	
37,000	37,000	.1405	.....	
38,000	38,000	.1590	.....	
39,000	39,000	.1750	.....	
40,000	40,000	.1975	.....	
42,000	42,000	.26	.....	
44,000	44,000	.32	.....	
46,000	46,000	.38	.....	
48,000	48,000	.45	.....	
50,000	50,000	.52	.....	
52,000	52,000	.61	.....	
54,000	54,000	.71	.....	
56,000	56,000	.84	.....	
58,000	58,000	1.03	.....	
60,000	60,000	1.36	.....	
60,800	60,800	.....	.....	Tensile strength.
0	0	1.49	.....	=14.9 per cent.

Elongation of inch sections: ″.11, ″.12, ″.13, ″.13, ″.15, ″.18, ″.26*, ″.14, ″.15, ″.12.

Diameter at fracture, 1″.01. Area, .801 square inch.

Contraction of area, 19.9 per cent.

Fracture occurred opposite the neck of the journal. Appearance of fracture, granular; spots of light colored metal near circumference. Opened cracks in cylindrical surface of stem in vicinity of place of rupture.

COMPRESSION TEST OF SPECIMEN TAKEN FROM STEM OF FRACTURED TENSILE SPECIMEN.

No. 4658*a*.

Length, 6″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 4″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4.000	5,000	.0004	.....	
8,000	10,000	.0008	.....	
12,000	15,000	.0015	0.	
16,000	20,000	.0022	.....	
20,000	25,000	.0027	0.	
24,000	30,000	.0035	.....	
28,000	35,000	.0042	.....	
32,000	40,000	.0050	.0001	
36,000	45,000	.0060	.0004	Elastic limit.
36,800	46,000	.0063	.....	
37,600	47,000	.0065	.....	
38,400	48,000	.0068	.....	
39,200	49,000	.0073	.....	
40,000	50,000	.0078	.0015	
40,800	51,000	.0082	.....	
41,600	52,000	.0089	.....	
42,400	53,000	.0098	.....	
43,200	54,000	.0107	.....	
44,000	55,000	.0118	.0048	
44,800	56,000	.0130	.....	
45,600	57,000	.0144	.....	
46,400	58,000	.0157	.....	
47,200	59,000	.0185	.....	
48,000	60,000	.0208	.0128	

Compression test discontinued.
Specimen turned down and tested by tension.

TENSION TEST OF SPECIMEN TAKEN FROM COMPRESSION SPECIMEN.

No. 4658*b*.

Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0002	.....	
2,000	10,000	.0007	.....	
3,000	15,000	.0012	.....	
4,000	20,000	.0018	.0001	
5,000	25,000	.0023	.....	
6,000	30,000	.0029	.0001	
7,000	35,000	.0035	.....	
8,000	40,000	.0041	.0001	
9,000	45,000	.0047	.....	
10,000	50,000	.0053	.0002	
11,000	55,000	.0062	.0006	
11,200	56,000	.0063	.....	
11,400	57,000	.0066	.....	
11,600	58,000	.0068	.....	
11,800	59,000	.0070	.....	
12,000	60,000	.0072	.0011	
12,200	61,000	.0075	.....	
12,400	62,000	.0078	.....	
12,600	63,000	.0081	.....	
12,800	64,000	.0085	.....	
13.000	65,000	.0089	.0023	
13,200	66,000	.0093	.....	
13,400	67,000	.0099	.....	
13,600	68,000	.0105	.....	
13,800	69,000	.0112	.....	
14,000	70,000	.0121	.0048	
14,200	71,000	.0130	.....	
14,400	72.000	.0138	.....	
14,600	73,000	.0148	.....	
14,800	74,000	.0160	.....	
15,000	75,000	.0179	.0099	
15,200	76,000	.02	.....	
15,400	77,000	.03	.....	
15,600	78,000	.08	.....	
15,800	79,000	.12	.....	
15,840	79,200	.20	.....	Tensile strength.
11,950	.....	.....	.....	Load at time of rupture.
0	0	.40	.....	=13.3 per cent.

Elongation of inch sections: ″.05, ″.27*, ″.08.
Diameter at fracture, ″.36. Area, .102 square inch.
Contraction of area, 49 per cent.
Fractured 1″.4 from the neck. Appearance, fine silky.

No. 4659.

Mark, B.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0016	.....	
10,000	10,000	.0036	.....	
15,000	15,000	.0052	.....	
20,000	20,000	.0070	.....	
25,000	25,000	.0088	.0001	
28,000	28,000	.0101	.....	
29,000	29,000	.0107	.....	Elastic limit.
30,000	30,000	.0119	.0019	
31,000	31,000	.0300	.....	
32,000	32,000	.0450	.....	
33,000	33,000	.0770	.....	
34,000	34,000	.0940	.....	
35,000	35,000	.1080	.....	
36,000	36,000	.1280	.....	
37,000	37,000	.1450	.....	
38,000	38,000	.1660	.....	
39,000	39,000	.1880	.....	
40,000	40,000	.1990	.....	
42,000	42,000	.26	.....	
44,000	44,000	.32	.....	
46,000	46,000	.37	.....	
48,000	48,000	.45	.....	
50,000	50,000	.51	.....	
52,000	52,000	.60	.....	
54,000	54,000	.71	.....	
56,000	56,000	.86	.....	
58,000	58,000	1.01	.....	
60,000	60,000	1.29	.....	
61,800	61,800	.....	.....	Tensile strength.
0	0	2.02	.....	= 20.2 per cent.

Elongation of inch sections: ″.13, ″.14, ″.15, ″.18, ″.43*, ″.24, ″.21, ″.19, ″.19, ″.16.

Diameter at fracture, ″.93. Area, .679 square inch.

Contraction of area, 32.1 per cent.

Fracture occurred in that part of the specimen taken from the journal of the axle and 2″ from the neck of the journal.

Appearance of fracture, silky. Surface contains several spots of light colored metal, the largest of which was ″.2 diameter. Opened cracks in cylindrical surface of stem.

THREE TENSION AND THREE COMPRESSION SPECIMENS TAKEN FROM END A BETWEEN WHEEL SEAT AND INITIAL STRAIN DISK A_3.

No. 4682.

COMPRESSION TEST.

Length, 6″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 4″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4,000	5,000	.0005	.....	
8,000	10,000	.0010	.....	
12,000	15,000	.0016	.....	
16,000	20,000	.0023	.0000	
20,000	25,000	.0030	.....	
24,000	30,000	.0038	0.	
24,800	31,000	.0040	.....	
25,600	32,000	.0042	.....	
26,400	33,000	.0043	.....	
27,200	34,000	.0045	.....	
28,000	35,000	.0047	.0002	Elastic limit.
28,800	36,000	.0052	.....	
29,600	37,000	.0117	.....	
30,400	38,000	.0450	.....	
31,200	39,000	.0553	.....	
32,000	40,000	.0695	.....	
49,100	61,375	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4683.

COMPRESSION TEST.

Length, 6″.
Diameter, 1″.0092.
Sectional area, 80 square inch.
Gauged length, 4″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4,000	5,000	.0004	.....	
8,000	10,000	.0010	.....	
12,000	15,000	.0016	.....	
16,000	20,000	.0023	0.	
20,000	25,000	.0030	.....	
24,000	30,000	.0037	0.	
24,800	31,000	.0040	.....	
25,600	32,000	.0041	.....	
26,400	33,000	.0044	.....	
27,200	34,000	.0048	.....	
28,000	35,000	.0052	.0006	Elastic limit.
28,800	36,000	.0385	.....	
29,600	37,000	.0438	.....	
30,400	38,000	.0480	.....	
31,200	39,000	.0520	.....	
32,000	40,000	.0587	.....	
48,420	60,525	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4684.

COMPRESSION TEST.

Length, 6″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 4″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4,000	5,000	.0005	.....	
8,000	10,000	.0011	.....	
12,000	15,000	.0018	.....	
16,000	20,000	.0025	0.	
20,000	25,000	.0031	.....	
24,000	30,000	.0038	.0002	
24,800	31,000	.0040	.....	
25,600	32,000	.0041	.....	
26,400	33,000	.0043	.....	
27,200	34,000	.0044	.....	Elastic limit.
28,000	35,000	.0048	.0005	
28,800	36,000	.0393	.....	
29,600	37,000	.0462	.....	
30,400	38,000	.0510	.....	
31,200	39,000	.0560	.....	
32,000	40,000	.0620	.....	
49,850	62,310	.....	.....	Ultimate strength.

Failed by triple flexure.

No. 4685.

TENSION TEST.

Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0003	.....	
2,000	10,000	.0009	.....	
3,000	15,000	.0013	.....	
4,000	20,000	.0019	.....	
5,000	25,000	.0024	.....	
6,000	30,000	.0030	0.	
6,200	31,000	.0031	.....	
6,400	32,000	.0032	.....	
6,600	33,000	.0035	.....	
6,800	34,000	.0038	.....	
7,000	35,000	.0040	.0002	Elastic limit.
7,200	36,000	.0195	.....	
7,400	37,000	.0386	.....	
7,600	38,000	.0445	.....	
7,800	39,000	.0490	.....	
8,000	40,000	.0532	.0487	
8,200	41,000	.0600	.....	
8,400	42,000	.0660	.....	
8,600	43,000	.0725	.....	
8,800	44,000	.0822	.....	
9,000	45,000	.0878	.....	
9,200	46,000	.0977	.....	
9,400	47,000	.1055	.....	
9,600	48,000	.1120	.....	
9,800	49,000	.1198	.....	
10,000	50,000	.1290	.....	
10,400	52,000	.1480	.....	
10,800	54,000	.18	.....	
11,200	56,000	.21	.....	
11,600	58,000	.24	.....	
12,000	60,000	.30	.....	
12,400	62,000	.40	.....	
12,800	64,000	.56	.....	
12,850	64,250	.70	.....	Tensile strength.
9,600	.....	.....	.....	At time of rupture.
0	0	1.02	.....	=34 per cent.

Elongation of inch sections: ″.22, ″.53*, ″.27.
Diameter at fracture, ″.32. Area, .0804 square inch.
Contraction of area, 59.8 per cent.
Appearance of fracture, fine silky.

No. 4686.

TENSION TEST.

Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
1,000	5,000	.0002	.....	
2,000	10,000	.0009	.....	
4,000	20,000	.0020	.....	
6,000	30,000	.0031	0.	
6,200	31,000	.0032	.....	
6,400	32,000	.0034	.....	
6,600	33,000	.0036	.....	Elastic limit.
6,800	34,000	.0040	.....	
7,000	35,000	.0048	.....	
7,200	36,000	.0340	.....	
7,600	38,000	.0438	.....	
8,000	40,000	.0547	.....	
8,400	42,000	.0670	.....	
8,800	44,000	.0830	.....	
9,200	46,000	.0980	.....	
9,600	48,000	.1140	.....	
10,000	50,000	.1325	.....	
10,400	52,000	.1585	.....	
10,800	54,000	.1820	.....	
11,200	56,000	.215	.....	
11,600	58,000	.27	.....	
12,000	60,000	.32	.....	
12,400	62,000	.39	.....	
12,800	64,000	.61	.....	Tensile strength.
10,100	.....	.....	.....	At time of rupture.
0	0	.97	.....	=32.3 per cent.

Elongation of inch sections: ″.28, ″.48*, ″.21.
Diameter at fracture, ″.31; area .0755 square inch.
Contraction of area, 62.2 per cent.
Appearance of fracture, fine silky.

No. 4687.

TENSION TEST.

Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	Initial load.
2,000	10,000	.0010	.....	
4,000	20,000	.0020	.....	
6,000	30,000	.0031	.0001	
6,200	31,000	.0032	.....	
6,400	32,000	.0035	.....	
6,600	33,000	.0037	.....	
6,800	34,000	.0039	.....	
7,000	35,000	.0041	.0007	Elastic limit (approximate).
6,800	34,000	.0043	.....	Immediate elongation. Sustained this load about 4 minutes, then elongation sensibly increased, and went on rapidly after 5 minutes' time.
.....	.....	.0107	.....	After 10 minutes.
7,000	35,000	.0119	.....	
7,200	36,000	.0330	.....	
7,600	38,000	.0452	.....	
8,000	40,000	.0572	.....	
8,400	42,000	.0670	.....	
8,800	44,000	.0820	.....	
9,200	46,000	.0970	.....	
9,600	48,000	.1150	.....	
10,000	50,000	.1325	.....	
10,400	52,000	.1608	.....	
10,800	54,000	.1825	.....	
11,200	56,000	.2140	.....	
11,600	58,000	.26	.....	
12,000	60,000	.31	.....	
12,400	62,000	.39	.....	
12,800	64,000	.60	.....	Tensile strength.
0	0	.96	.....	=32 per cent.

Elongation of inch sections: ″.42* ″.32, ″.22.
Diameter at fracture, ″.31. Area, .0755 square inch.
Contraction of area, 62.2 per cent.
Appearance of fracture, fine silky.

TABULATION OF TENSION SPECIMENS FROM STEEL RAILWAY AXLE.

No. of test.	Marks.	Diameter.	Sectional area per square inch.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 3 inches or 10 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Inches.	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		" " " " " " " " " "
4651	A	1.129	1.00	33,000	63,340	27.0	55.8	Fine silky	.13, .20, .21, .23, .21, .24, .40. .62*, .27, .19
4652	A	1.129	1.00	30,000	62.710	26.6	54.6	do	.13, .17, .20, .23, .22, .24, .30, .68*, .31, .18
4652*a*	A	.505	.20	.....	86,200	9.0	46.0	do	.24*, .02, .01
4653	A	1.129	1.00	32,000	62,980	27.2	55.8	do	.15, .20, .23, .25, .27, .64*, .35, .23, .22, .18
4654	A B	1.129	1.00	35,000	63,120	22.4	37.8	Silky, oblique	.15, .19, .19, .20, .20, .20, .29, .45*, .21, .16
4655	A B	1.129	1.00	35,000	63,100	24.5	53.4	Silky, with lighter spots	.16, .17, .19, .22, .19, .19, .38, .57*, .22, .16
4655*b*	A B	.505	.20	.....	85,000	8.0	46.0	Fine silky	.23*, .01, .00
4656	A B	1.129	1.00	36,000	63,210	24.0	43.3	Silky	.16, .19, .18, .20, .25, .52*, .33, .22, .19, .16
4657	B	1.129	1.00	30,000	60,500	16.4	23.0	Granular, 60 per cent; silky 40 per cent	.13, .15, .17, .18, .31*, .18, .16. .12, 13, .11
4658	B	1.129	1.00	30,000	60.800	14.9	19.9	Granular, with lighter spots	.11, .12, .13, .13, .15, .18, .26*, .14, .15, .12
4658*c*	B	.505	.20	.....	79,200	13.3	49.0	Fine silky	.05, .27*, .08.
4659	B	1.129	1.00	29,000	61,800	20.2	32.1	Silky, with light-colored spots	.13, .14, .15, .18. .43, .24, .21, .19, .19, .16
4685	.....	.505	.20	35,000	64,250	34.0	59.8	Fine silky	.22, .53*, .27
4686	.....	.505	.20	33,000	64,000	32.3	62.2	do	.28. .48*, .21
4687	.....	.505	.20	35 '000	64,000	32.0	62.2	do	.42*, .32, .22

a Turned down from compression specimen No. 4652*a*. *b* Turned down from compression specimen No. 4655*a*. *c* Turned down from compression specimen No. 4658*a*.

TABULATION OF COMPRESSION SPECIMENS FROM STEEL RAILWAY AXLE.

No. of test.	Marks.	Length.	Diameter.	Sectional area.	Elastic limit per square inch.	Maximum load applied per square inch.	Ultimate strength per square inch.	Manner of failure.	Remarks.
		Inches.	*Inches.*	*Sq. inch.*	*Pounds.*	*Pounds.*	*Pounds.*		
4652*a*	A	6	.991	.771	49,000	65,000	.....	.....	Specimen taken from end of fractured tension specimen No. 4652.
4655*a*	A B	6	1.0092	.80	49,000	65,000	.....	.....	Specimen taken from end of fractured tension specimen No. 4655.
4658*a*	B	6	1.0092	.80	45,000	60,000	.....	.....	Specimen taken from end of fractured tension specimen No. 4658.
4682	.....	6	1.0092	.80	35,000	.....	61,375	Triple flexure	
4683	.....	6	1.0092	.80	35,000	.....	60,525	....do	
4684	.....	6	1.0092	.80	34,000	.....	62,310	....do	

STEEL RAILS.

These tests were made with rails which were collected and contributed by Mr. P. H. Dudley.

The tests comprise transverse, tensile, compression, and shearing tests, also chemical analyses of the principal elements.

The rails are described as follows:

No. 8.—A section of a new steel rail manufactured by the Albany and Rensselaer Iron and Steel Company, of Troy, N. Y., and branded "A. R. I. and S. C., Troy Steel, 1884 23."

No. 9.—A piece of an old steel rail from the Boston and Albany Railroad, the part of the brand which was in sight reading "London Siemen."

Nos. 10 to 17, inclusive, were sections of new steel rails furnished for test by Mr. F. A. Delano, from the Chicago, Burlington and Quiney Railroad.
The rails are said to have been made by the North Chicago Rolling Mill Company, Chicago, Ill.

No. 18.—A section of old steel rail taken from the track of the Norwich and Worcester Railroad, where it had been in service a period of twenty years. It was branded "Barrow Steel, 1868 ⁝· ."

No. 19.—A section of old steel rail taken from the track of the Norwich and Worcester Railroad, where it had been in service for a period of twenty years. This is said to have been made by John Brown & Co., Sheffield, England, in the year 1866. It was branded "6 Sec. No. 65."

No. 20.—A section of old iron rail of English manufacture taken from the track of the Norwich and Worcester Railroad, where it was laid in the year 1843. The brand, which was indistinct, read "Crawshaw B. 4."

No. 21.—A section of old steel rail from the track of the New York and New England Railroad. It was manufactured by the Pennsylvania Steel Company, and branded "P. S. Co. 1879."

No. 22.—A section of old steel rail from the New York and New England Railroad, branded "12 A. & R. I. & Sc. Troy Steel. 1883 12."

No. 23.—A section of new steel rail from the New York and New England Railroad, branded "Lack[a] I. & C. Co., Scranton 4-89."

No. 24.—A section of old steel rail of German manufacture, branded "G. H. Hutte, 1880."

No. 25.—A section of old steel rail branded "Cammel Sheffield Toughened Steel, 1873."

No. 26.—A section of old steel rail without brand, but said to be Chas. Cammel's manufacture.

No. 27.—A section of old steel rail branded "John Brown & Co., Sheffield Atlas Steel $\frac{7}{74}$ Sec. 68."

No. 28.—A section of old steel rail branded "Barrow Steel 1873 :::: 55."

No. 29.—A section of old steel rail without brand, but said to be of John Brown & Co.'s manufacture.

No. 30.—A section of old steel rail manufactured by the Bethlehem Iron Company, and branded "B. I. Co. 76."

No. 31.—A section of old steel rail branded "Dowlais steel 7 70 Guaranteed."

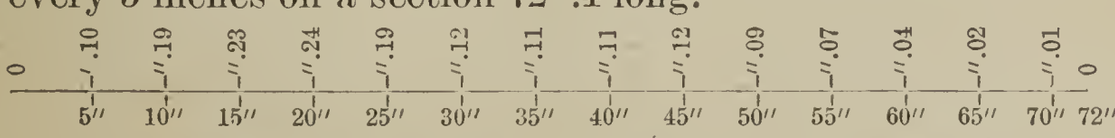
No. 32.—A section of old steel rail which was manufactured by the American Bessemer Steel Company, of Duquesne, Pa., branded "A-B-S-89 111."

No. 33.—A section of new steel rail branded "Scranton Steel Co. 3 89."

No. 34.—An old steel rail manufactured by the Worcester Iron Company, branded "W. I. Co. Steel 82."

The total length of this rail when received for testing was 34′ 6″. An irregular granular fracture was presented at one end about 6″ from the original end of the rail; the fracture occurred about midway the two bolt holes.

The base was worn where it had rested upon the ties, the amount of abrasion ranging from ″.01 to ″.04. The rail was in a bent condition when taken from the track, as shown by the following ordinates measured every 5 inches on a section 72″.4 long.



No 35.—A section of old steel rail manufactured by the Chicago Rolling Mill Company and branded "C. R. M. Co. 12 75."

Nos. 36 and 37.—Sections of old steel rails branded "Wilson Cammel Co.'s Steel Sec. $\frac{6}{74}$ Dronfield."

CHEMICAL COMPOSITION AND HARDNESS OF HEADS.

No. of rail.	Brand.	Chemical composition.								Hardness.	Remarks.
		Combined carbon.	Graphite carbon.	Total carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.		
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
9	Part of brand in sight, "Landore Siemen"	.420	.017	.437	.347	.044	.079	.153	.022	19.81 20.93	
10	Nos. 10 to 17, inclusive, were rolled by the North Chicago Rolling Mill Co., Chicago, Ill.	.468	.035	.503	1.062	.063	.079	.096	.013	.....	
11		.420	.037	.457	1.337	.042	.081	.090	.009	.....	
12		.502	.028	.530	1.223	.014	.060	.097	.012	.....	
13		.370	.048	.418	1.110	.064	.070	.104	.013	.....	
14		.417	.061	.478	1.326	.024	.057	.106	.019	.....	
15		.408	.022	.430	1.227	.048	.059	.118	.024	.....	
16		.450	.030	.480	1.241	.017	.072	.096	.006	.....	
17		.481	.022	.503	1.327	.095	.164	.076	.019	.....	
18	"Barrow Steel, 1868 : · ".....	.241	.029	.270	.471	.523	.055	.117	.013	34.70 35.62 22.39	Hardness 1 inch from end of rail. Hardness ¼ inch below surface of head.
19	"6 Sec. No. 65." (Said to have been made by John Brown & Co., Sheffield, England.)	.498	.016	.514	.566	.096	.042	.063	.039	29.04 32.10	Hardness 1 inch from end of rail.
20	"CRAWSHAW B 4." (Indistinct.)	.084	.011	.095	None.	.267	.039	.259	.022	21.64 25.89	Hardness .9 inch from end of rail.
21	"P. S. Co., 1879".....	.325	.029	.354	.902	.050	.101	.070	.261	25.73 27.99 17.99	Hardness 2.5 inches from battered end of rail. Hardness ¼ inch below surface of head.
22	"12 A. & R. I. & Sᵉ Troy Steel, 1883, 12."	.308	.025	.333	.842	.038	.110	.095	.130	23.84 20.93 16.64	Hardness ¼ inch below surface of head.
23	"Lackᵃ I. & C. Co., Scranton, 4-89."	.412	.012	.424	1.172	.068	.095	.087	.265	21.64 21.89	
24	"G. H. Hutte, 1880".....	.252	.010	.262	.662	.474	.043	.098	.155	29.04 27.48 23.17	Hardness ¼ inch below surface of head.
25	"Cammel Sheffield Toughened Steel, 1873."	.228	.023	.251	.351	.047	.075	.124	.055	25.28 25.13 17.62	Hardness ¼ inch below surface of head.
26	Paint on head, "22-8." (Said to be of Chas. Cammel's manufacture.)	.190	.048	.238	.383	.068	.067	.092	.015	27.65 26.04	
27	"John Brown & Co., Sheffield, Atlas Steel $\frac{7}{74}$ Sec. 68."	.285	.018	.303	.704	.115	.090	.111	.039	21.05 22.27	

28	"Barrow Steel, 1873:::: 55"..	.172	.028	.200	.286	.143	.059	.065	.021	26.83 26.04	
29	No brand (said to be of John Brown & Co's manufacture).	.321	.016	.337	.347	.016	.127	.048	.032	13.85 14.26	
30	"B. I. Co. Steel, 76".....	.260	.017	.277	.523	.047	.076	.101	.130	24.40 25.28 21.64	Hardness ¼ inch below surface of head.
31	"Dowlais Steel, 7 70 Guaranteed."	.405	.033	.438	.474	.045	.060	.080	.052	24.54 25.58	
32	"A-B-S, 89 111".....	.426	.033	.459	1.000	.174	.065	.121	.022	21.52 23.30	
33	"Scranton Steel Co., 3 89"...	.481	.010	.491	.980	.057	.084	.083	.068	25.73 25.73	
34	"W. I. Co. Steel, 82".....	.262	.014	.276	.495	.023	.057	.070	.020	.....	
36	"Wilson Cammel Co.'s Steel, Sec. $\frac{6}{74}$ Dronfield."	.....	.....	.....	.....	.....	.....	.....	.....	27.32 21.89	Hardness ¼ inch below surface of head.
37	.....do.....	.....	.....	.....	.....	.....	.....	.....	.....	30.33 20.03	Hardness ¼ inch below surface of head.

Rail No. 20 is iron.

Check determinations of silicon gave the following results: Rail No. 18, .496 per cent; rail No. 24, .502 per cent.

Hardness of steel rail No. 34 taken at intervals along top of head at places where the head had high and low spots.

Distance of hardness cut from initial end of rail stated below. High spots indicated by + sign, low spots by — sign.

Distance from end.	High or low spot.	Height of rail.	Hardness.	Distance from end.	High or low spot.	Height of rail.	Hardness.
Inches.		*Inches.*		*Inches.*		*Inches.*	
Initial end.	.....	4.46	.....	191.....	+	4.42	27.80
4.....	+	4.37	26.99	204.....	—	4.42	33.15
17.....	—	4.27	31.30	214.....	+	4.43	29.77
31.....	+	4.36	28.68	222.....	—	4.43	29.40
44.....	—	4.37	29.59	230.....	+	4.44	27.17
57.....	+	4.40	30.14	245.....	—	4.44	28.33
68.....	—	4.38	26.51	259.....	+	4.43	28.88
78.....	+	4.39	26.99	270.....	+	4.46	26.83
88.....	—	4.38	28.68	277.....	—	4.46	32.31
101.....	+	4.40	27.32	286.....	+	4.47	29.77
115.....	—	4.38	26.83	295.....	—	4.44	26.99
126.....	+	4.38	*30.33	306.....	+	4.44	30.52
140.....	—	4.43	35.39	322.....	—	4.42	29.77
148.....	—	4.42	27.80	338.....	—	4.43	26.83
160.....	+	4.45	29.04	350.....	+	4.44	29.95
178.....	—	4.42	25.88	354.....	Final end.		

* Excessively laminated in this vicinity.

Head of rail planed off $\frac{1}{8}''$ and hardness then determined and found to be 14.54.

STEEL RAILS. TRANSVERSE TESTS.

The rails were supported at the ends on semicylindrical bearings, and loaded at the middle. The usual distance apart for the supports was 30 inches—the length of section received for testing in some cases required a shorter span to be employed, and in some instances longer spans were tested for the purpose of determining the relative deflections for different lengths between supports.

Rails were loaded on the heads and also on the bases, their deflections observed and ultimate strength determined.

The elastic limits were somewhat vague and uncertain; they were established, however, at the load beyond which the deflections showed a progressive rate of increase under equal increments of load.

The fiber stresses were computed by the formula

$$R=\frac{Pld_1}{4I}$$ in which

R=fiber stress.
P=load applied.
l=length between supports.
d_1=distance of most remote fiber from neutral axis.
I=moment of inertia of cross-section.

The apparent moduli of elasticity were computed by the formula

$$E=\frac{Pl^3}{48\,\Delta\,I}$$ in which

E=modulus of elasticity.
P=load applied.
l=length between supports.
Δ=deflection.
I=moment of inertia of cross-section.

The loads and deflections used were those next below the elastic limit where sets were determined, and in the computations the permanent sets were deducted; the moduli of elasticity, therefore, represent the resilience of the rails.

The moduli of elasticity of the tensile specimens taken from these rails were in the vicinity of 29,000,000 to 30,000,000 pounds per square inch. It will be observed that under transverse loads the moduli of elasticity are very much lower, a result which is attributed chiefly to the form of the rails, but in part modified by the compression of the end supports, which would tend to increase the deflections, apparently.

Referring to the individual tests, test No. 89 is the test of rail No. 9. In the original test, reported in Tests of Metals, 1889, page 442, loads were applied to the head; the maximum load, 60,000 pounds, was then applied, which on the 30″ span employed gave a fiber stress of 83,600 pounds per square inch. In the present test the rail was loaded on the base, putting the metal of the head in a state of tension. Fracture occurred under 86,400 pounds per square inch fiber stress.

There was a significant appearance to the fractured surface. It presented a granular appearance, except the metal near the surface of the head fractured with an oblique smooth surface, resembling in appearance the fracture of a sheared specimen.

The abrasive action of the wheels on the head of the rail was accompanied by a flow of the metal and fins were formed on both sides of the head. In describing the results obtained from rail No. 34 the peculiarities of this kind of fracture will be referred to more at length.

Test No. 58 of rail No. 15: Loads were first applied to the head of the rail and were increased to 14,000 pounds total load; then followed a rest without load of 14 months, after which the test was resumed with the rail in reversed position, now loading the base. After several reversals the middle section was heated to a red heat, then followed additional loadings in both positions, then a second heating at nearly the same temperature as before, and additional loadings in both positions.

During the first series of loadings the sets were of small magnitude until the elastic limit had been passed; but after the sets caused by the higher loads had been given the rail then the lower loads of the second series, with the rail in reversed position, caused greater sets than before, and notwithstanding the intervening rest of 14 months.

The effect of overloading in one direction was thus shown to tend to cause early and larger sets when loaded in the reverse position.

Heating the rail to a red heat corrected this effect in a measure, but did not fully restore the rail to its original condition as regards taking sets.

Three tests were made with rail No. 21. In the first test, No. 80, the load was applied on the head. The full strength was probably not developed on account of an indented flange, caused either by the abrasion of a spike or the result of a hammer blow.

This defect was 2 inches distant from the middle of the specimen as it rested on the supports, but located the fracture, which began at the indented corner, and from these extended across the rail.

The fractured surface in the vicinity of the top surface of the head, where the metal had flowed under the wheel pressures, presented an oblique sheared appearance. The breaking load was 88,000 pounds.

In test No. 81 the rail was so placed that a notch in one flange, 1″.40 long by ″.83 deep, came at the middle of the specimen. The notch had apparently been made with a cold chisel, which left sharp corners to the cut. The breaking load was 51,400 pounds, a reduction in strength of 36,600 pounds from the preceding test.

In test No. 82 the rail was loaded on the base. The breaking load was 74,900 pounds. All of the fractures of this rail showed a disturbed condition of the metal under the wheel pressures, the smooth sheared appearance penetrating to a depth of ″.08.

Two tests were made with rail No. 22. In the first test, No. 83, loads were applied on the head, and the maximum load, 100,000 pounds, reached, after which the rail was reversed and loaded on the base, in which position fracture occurred at 97,900 pounds.

In the second test, No. 84, the rail was loaded on the base and fractured at 91,200 pounds. In each fracture there was a smooth sheared appearance of the metal laying next the top surface of the head.

Rail No. 23, test No. 85, was subjected to alternate stresses, and after several reversals was heated along the middle of its length to the estimated temperature, 1780° F.

The effect of the previous overloading when the rail was reversed in position was shown by the tendency to develop sets under low loads as before observed.

After two reversals and an interval of rest of 5½ minutes, the sets were smaller during the next series of loadings. There was also a marked diminution in the magnitude of the sets following the annealing at 1780° F.

The ultimate strength of the rail was determined, but without fracture of the metal, the flanges buckled and lateral deflection occurred.

Rail No. 29, test No. 64, was subjected to alternate stresses, and with an intervening period of rest. The characteristic features observed in other overloaded rails were repeated in this test.

After once overloading, the rail developed early and larger permanent sets when the loads were reversed, but after a number of repetitions of stresses the sets eventually became much smaller. Thus we observe that when the rail was first loaded with 50,000 pounds on the head there was a set of ″.3840, and when reversed in position and loaded on the base the same load caused a set of ″.4268, but under the last two loadings of the series the sets were ″.1237 and ″.1600, caused by loads of 50,000 pounds on the base and head, respectively.

There was a marked effect of the rest of four months on the sets when the test was resumed, whereas the set increased ″.0152 between the loads 10,000 pounds and 20,000 pounds just preceding the interval of rest; an equal increment of load, between 20,000 pounds and 30,000 pounds, after the rest, caused an increase in the set of only ″.0022. These loads were applied to the head of the rail in each instance.

While this appears to indicate a tendency on the part of the metal to recover from the effect of overloading, the sets still remaining low after several reversals of stresses not exceeding 35,000 pounds, unfortunately it can not be said that the restoration was yet complete. The application of higher stresses caused a return of larger sets.

Phenomena of this class are thought to have an intimate bearing on the solution of questions relating to the ultimate endurance or determination of metals, and a consideration of these phenomena bring into prominence practical questions relating to the effect of different methods of straightening new rails.

Rail No. 30, test No. 65, was first loaded up to 20,000 pounds on the base for the purpose of comparing the deflections when thus loaded with the deflections when loaded on the head.

Deducting the permanent sets, and the deflections were ″.0397 and ″.0385 when loaded on the base and head respectively; thus showing the greater deflection when loaded on the base.

Other tests have shown the opposite result, the deflections greater when loaded on the head.

A section of this rail, in test No. 74, fractured, displaying the smooth sheared appearance next the top surface of the head previously referred to.

In test No. 75, another section of the same rail fractured, beginning at a drilled hole through the web. The hole was located 4½ inches from the middle of the length of the specimen.

Rail No. 32, test No. 66, was subjected to alternate stresses, and a very extensive series of micrometer observations taken to show the deflections and sets which resulted therefrom.

The subjoined table is arranged to show the sets which occurred when the rail was loaded on the head as modified and affected by each intervening load on the base.

Thus the first loading given the rail was on the base, when 50,000 pounds was applied, which load caused a set of ″.0005. This load was within the elastic limit of the metal; hence when the rail was reversed in position and loaded upon the head, the sets did not begin to appear until 50,000 pounds had been reached, when the set was ″.0008.

The elastic limit was 60,000 pounds total, or 61,810 pounds per square inch maximum fiber stress. When this load was released to the initial load, the set was ″.0028. Loads were continued on the head up to 90,000 pounds, which caused the set to reach ″.1068.

This disturbance produced a marked effect when the rail was reversed and loaded on the base, for a load of 20,000 pounds on the base now caused the set ″.0111, whereas before disturbing the metal 50,000 pounds' load had only caused a set of ″.0005.

As succeeding higher loads were applied to the base the sets increased, reaching ″.3105, the greatest observed after 100,000 pounds load.

The effect of gradually increasing loads on the base when the rail was reversed and loaded in the opposite direction is shown in the table by the gradual increase of sets under the loads 10,000 pounds and 20,000 pounds, and under the higher loads which were eventually reached.

After reaching 100,000 pounds the repetition of this stress did not cause an increase in the magnitude of the sets, but, on the other hand, there was a falling off in the total amount observed.

A rest of 3 months 27 days caused a marked temporary reduction in the sets, which was followed by higher sets when the loadings were resumed; still the sets did not again reach their maximum values.

The significance of this behavior of the metal to endure repeated stresses without increase of sets, displaying, in fact, a tendency towards diminished sets under a constant maximum load, is of unusual importance.

Taken in connection with the fact that the continued application of such loads will eventually rupture the metal, the deduction follows that an old rail which has been repeatedly overstrained might be expected to fracture without displaying an increase in permanent sets.

SETS CAUSED BY ALTERNATE LOADS ON BASE AND HEAD OF RAIL. TABULATED TO SHOW THE SETS CAUSED BY LOADS ON THE HEAD AFTER EACH APPLICATION OF LOAD ON THE BASE.

On base of rail.		On head of rail.									
Loads applied.	Sets.	Sets caused by loads on head of rail, in pounds of—									
		10,000.	20,000.	30,000.	40,000.	50,000.	60,000.	70,000.	80,000.	90,000.	100,000.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
50,000	.0005	0.	—.0002	0.	0.	.0008	.0028	.0085	.0247	.1068	.....
20,000	.0111	.0003	+.0008	.....	.....	.....	.....	.....	.....	.....	.....
40,000	.0215	.0009	.0017	.....	.....	.....	.....	.....	.....	.....	.....
60,000	.0355	.0012	.0027	.....	.....	.....	.....	.....	.....	.....	.....
80,000	.0633	.0020	.0056	.....	.....	.....	.....	.....	.....	.....	.....
90,000	.0558	.0028	.0080	.....	.....	.....	.....	.....	.....	.....	.....
100,000	.1223	.0047	.0131	.0232	.0388	.0626	.0925	.....	.....	.....	.....
100,000	.1245	.0046	.0123	.0230	.0390	.0630	.0905	.1327	.1695	.2430	.3422
100,000	.3105	.0035	.0098	.0190	.0311	.0488	.0727	.1088	.1545	.2177	.3055
100,000	This load applied ten times each on head and base.										
100,000	.2914	.0037	.0093	.0182	.0295	.0450	.0675	.0990	.1372	.2024	.2865
100,000	.2818	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Rested three months and twenty-seven days.										
.....	.....	.0002	.0003	.0007	.0023	.0066	.0150	.0328	.0455	.1010	.1874
100,000	Not taken ..	.0027	.0078	.0140	.0229	.0353	.0519	.0755	.1066	.1504	.2206
100,000	Apphed ten times each on head and base.										
100,000	.2695	.0043	.0095	.0177	.0285	.0436	.0648	.0949	.1360	.1947	.2620
100,000	Applied ten times each on head and base.										
100,000	.2695	.0035	.0087	.0171	.0270	.0427	.0631	.0921	.1335	.1887	.2662

Rail No. 34.—In test No. 67 the end supports were placed 54″, 42″, and 30″ apart successively, and deflections measured in each position when loaded on the head and on the base.

The deflections were relatively greatest with the least span—that is, the deflections did not vary directly as the cube of the spans, but as the distance between supports was diminished the deflections appeared to increase proportionally.

The relative influence of the end bearings as affecting the apparent deflections would decrease with increase of the span.

The modulus of elasticity when computed from the data of the 54″ span, the load being applied to the head of the rail, was 25,370,000 pounds per square inch against 21,560,000 pounds per square inch, the apparent value when loaded on the 30″ span.

After observing the deflections at different spans when the rail was loaded on the head, the span being 30″ at the time, the stress was increased to 80,000 pounds total load, then the rail was reversed and loaded on the base. At 76,000 pounds fracture occurred.

The appearance of the fractured surface was granular, except the metal near the top surface of the head, which presented a smooth, sheared appearance to a depth of about ″.05.

In test No. 68 the load was applied to the base of the rail.

Fracture occurred at 61,770 pounds per square inch maximum fiber stress, which it will be observed is much below the strength of any of the tensile specimens taken from this rail.

The appearance of the fractured surface was the same as before described.

In test No. 92 the top surface of the head had been planed off and the corners rounded, reducing the height of the rail about ″.20, where the most metal was removed, and on the lower side of the head about ″.10.

This apparently removed the metal which had been directly disturbed by the wheel pressures on the head of the rail, for the remaining metal now displayed toughness and ductility.

The rail bent through an angle of 37° without fracture with the head being on the tension side of the bend.

In test No. 93 the rail was bent through an angle of 50° without fracture with the base on the tension side of the bend.

In tests Nos. 69 and 70 the former was loaded on the base and fractured in a brittle manner under 63,900 pounds, while the latter sustained 99,800 pounds, when it failed by continuing to bend, the metal not rupturing.

In test No. 71 a section of rail was used which had granular fractures at each end, which had been caused by bending with the head on the tension side, the fractures having been caused without appreciable permanent deflection preceding rupture. In this test the bending was done in the reverse direction, the load being applied to the head.

The rail bent through an angle of 25°, when a crack was started in one flange at a place where a spike had worn away the metal, making a notch about ″.10 deep.

Another piece of this rail, test No. 72, had the head planed off, removing part of the metal affected by the wheel pressures, but leaving at the corners some of the disturbed metal, the presence of which metal apparently caused a brittle fracture. The load was applied to the base.

One of the ends was taken after fracture, its corners rounded, when it then bent through an angle of 40° without fracture.

The head was cut off the other fractured end, taking a cut along the web, the corners of the head rounded, and it was then bent through 60° without fracture.

The top surface of the head was on the tension side of the bend.

In a similar manner the head was cut off from the section of rail used in test No. 73, leaving the top surface untouched. This was bent with the top on the tension side. A brittle fracture followed.

In test No. 73*b* the head of the rail, which had been cut off by a cut taken along the web as in the other instances, was exposed to a high scaling heat, and, after cooling, the piece of head was bent through an angle of 58° without fracture, the top surface being on the tension side.

The flow of the metal in the head of rail No. 34 took place in both directions, forming a fin on the inside and on the outside. Along the middle of the top surface the head was concave and showed the flattened edges of flaky metal.

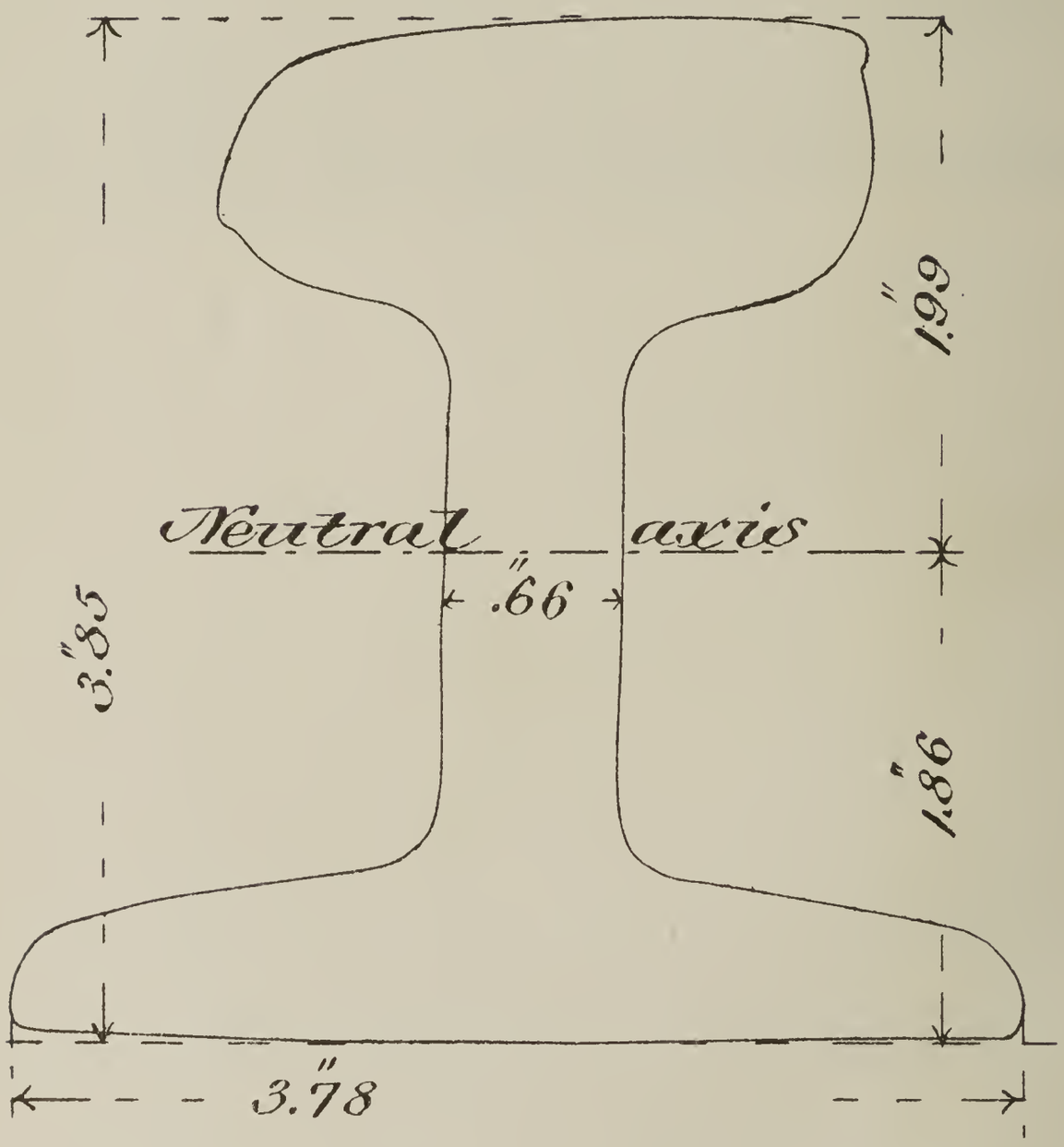
The part of the fracture lying next the top surface of the head, which is described as having an oblique sheared appearance, took, in each case, an inclination from the direction the traffic passed over the rail.

It is apparent that those rails which had endured much distortion of the metal of the heads under the wheel pressures were consequently in a weakened and brittle condition when exposed to loads bending them with the head on the tension side, although when bent in the reverse direction they displayed greater strength and toughness.

The restoration of the section of head of rail No. 34, by exposure to a high scaling heat, indicates that the brittle condition does not require, necessarily, the presence of incipient fractures.

No. 9.

Branded, "Landore Siemen"



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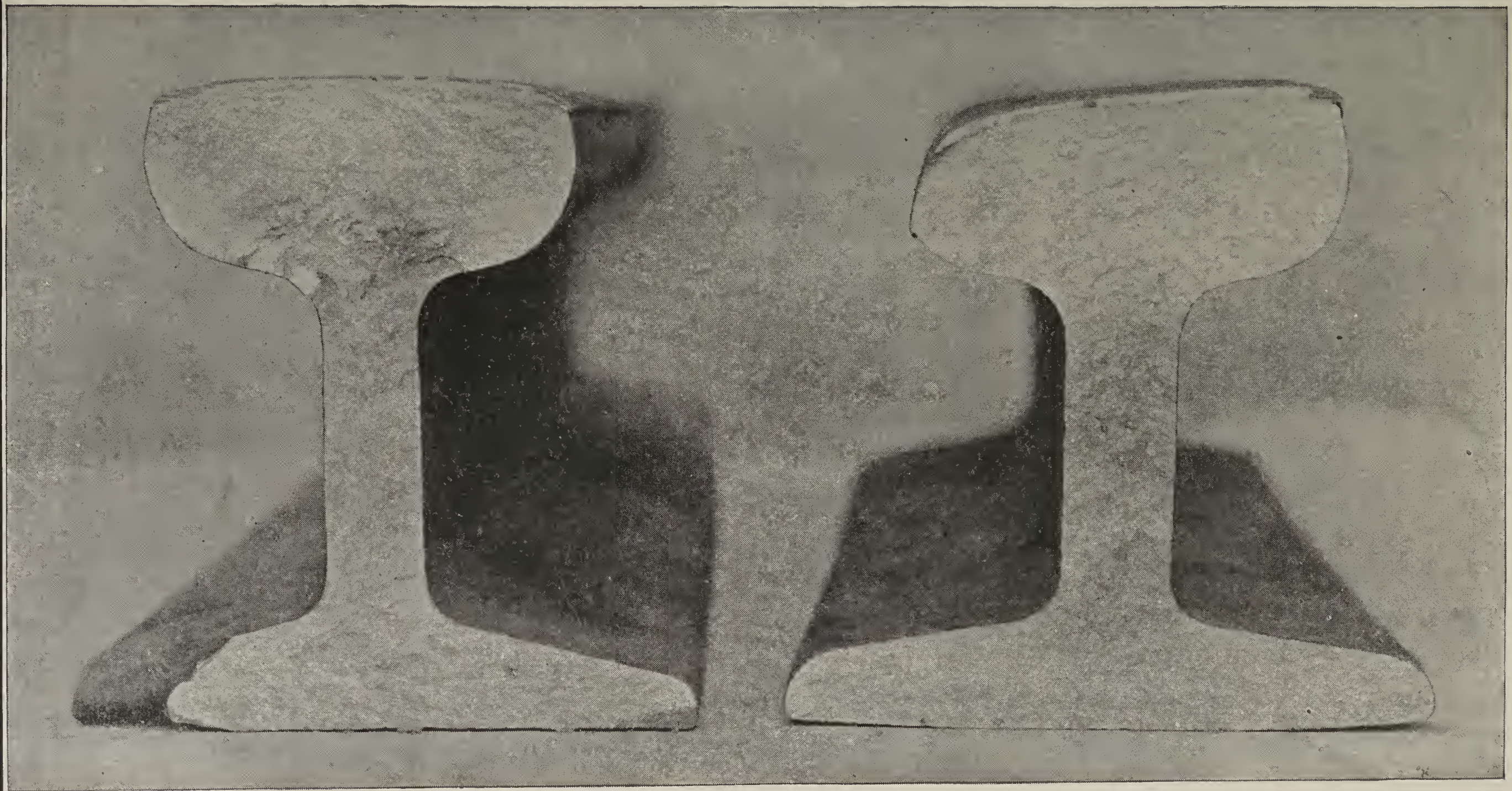


No. 21.

No. 9.

No. 89.

Rail No. 9.

Part of brand in sight, "Landore Siemen."

Supplementary test (see Report of Tests of Metals, 1889, page 442, for original test): Height, 3″.85; width of base, 3″.78; weight per yard, 58.9 pounds.

Ends supported 22″.1 apart.

Loaded on base at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,320	.01	.01	.....	
20,000	20,630	.03	.02	.....	
30,000	30,950	.04	.01	.....	
40,000	41,260	.05	.01	.....	
50,000	51,580	.08	.03	.....	
55,000	56,730	.09	.01	.....	
60,000	61,890	.12	.03	.....	
65,000	67,050	.17	.05	.....	
70,000	72,210	.25	.08	.....	
75,000	77,360	.36	.11	.....	
80,000	82,520	.46	.10	.....	
84,180	86,400	.....	.....	.....	Ultimate strength.

Granular appearance, radiating from the top of the head. The metal at the top surface of the head to a depth of ″.04 to ″.06 had a smooth sheared appearance.

The metal had flowed under the wheel pressures and had formed a fin on each side of the head.

No. 58.

Steel Rail No. 15.

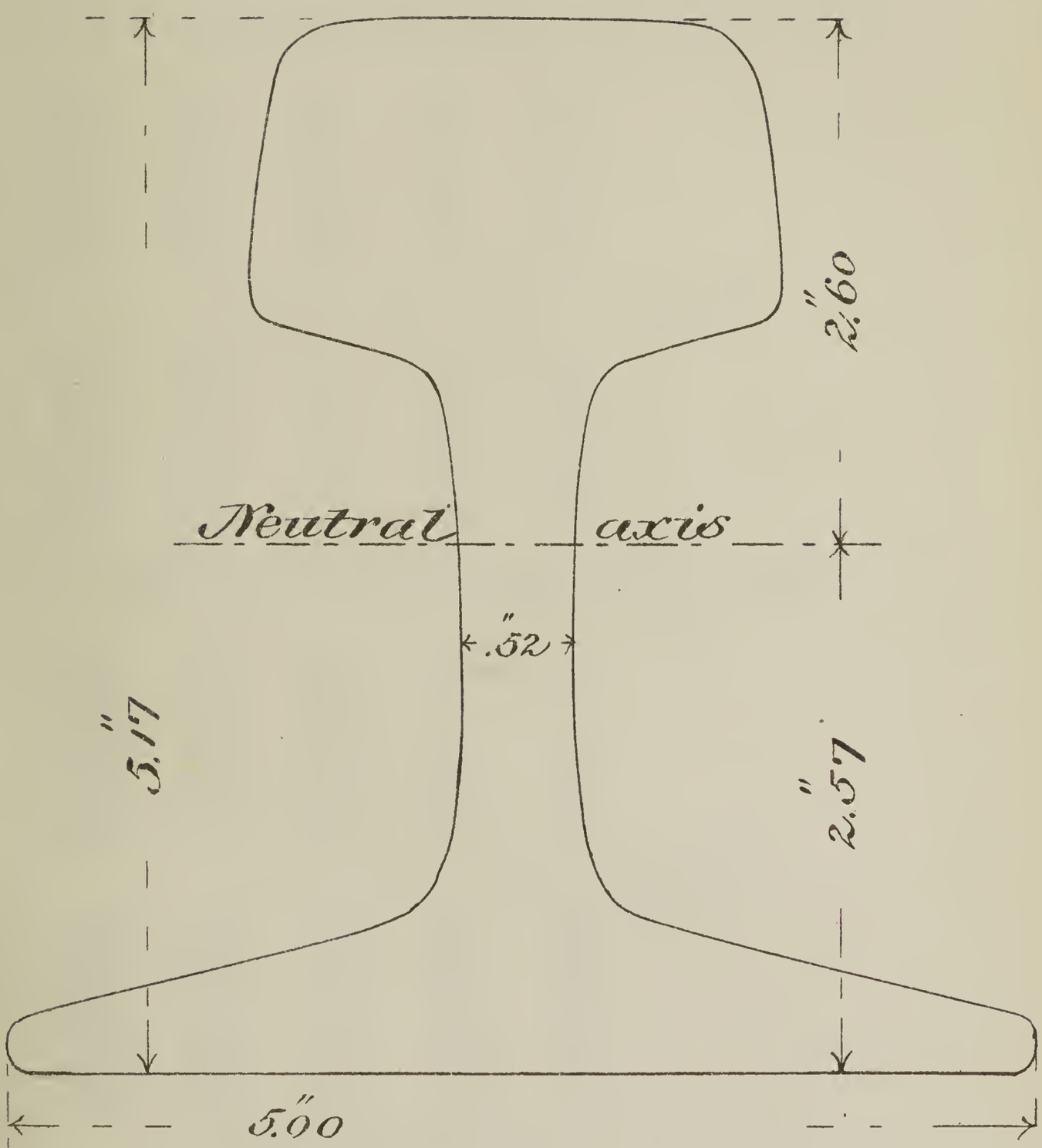
McClure section (Mark, 5602) rolled by the North Chicago Rolling Mill Company, Chicago, Ill.: Height, 5″.17; width of base, 5″; weight per yard, 83½ pounds.

Ends supported 30″ apart.

Loaded on head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	1,320	0.	0.	0.	Initial load.
10,000	6,620	.0093	.0093	.0004	
20,000	13,240	.0193	.0100	.....	
30,000	19,860	.0289	.0096	.....	
40,000	26,480	.0379	.0090	.0008	
50,000	33,100	.0470	.0091	.....	
60,000	39,720	.0560	.0090	.....	
70,000	46,340	.0650	.0090	.....	
80,000	52,960	.0735	.0085	.0011	
90,000	59,580	.0833	.0098	.0026	
92,000	60,910	.0851	.0018	.....	
94,000	62,230	.0871	.0020	.....	
96,000	63,550	.0891	.0020	.....	
98,000	64,880	.0912	.0021	.....	
100,000	66,200	.0933	.0021	.0038	E=20,910,000.
102,000	67,530	.0957	.0024	.....	
104,000	68,850	.0979	.0022	.....	
106,000	70,170	.1002	.0023	.....	
108,000	71,500	.1024	.0022	.....	Elastic limit.
110,000	72,820	.1050	.0026	.0062	
112,000	74,150	.1077	.0027	.....	
114,000	75,480	.1100	.0023	.....	
116,000	76,800	.1127	.0027	.....	Scale starts off.
118,000	78,120	.1157	.0030	.....	
120,000	79,440	.1188	.0031	.0108	
122,000	80,770	.1223	.0035	.....	
124,000	82,090	.1259	.0036	.....	
126,000	83,720	.1323	.0064	.....	
128,000	84,740	.1428	.0105	.....	
130,000	86,060	.1540	.0112	.0360	
132,000	87,390	.1695	.0155	.....	
134,000	88,710	.1942	.0247	.....	
136,000	90,040	.2050	.0108	.....	
138,000	91,360	.2125	.0075	.....	
		.2360	.0235	.....	
140,000	92,680	.2478	.0118	.....	After 5 minutes.
		.2520	.0042	.1205	After 10 minutes.
Rail removed from machine and rested 14 months.					
Tested in reversed position, the load being applied to the base of the rail at the middle of its length.					
2,000	1,320	0.	0.	0.	Initial load.
10,000	6,620	.0095	.0095	.0003	
20,000	13,240	.0200	.0105	.0005	
30,000	19,860	.0298	.0098	.0007	
40,000	26,480	.0395	.0097	.0010	
50,000	33,100	.0498	.0103	.0021	
60,000	39,720	.0610	.0112	.0045	
70,000	46,340	.0745	.0135	.0092	
80,000	52,960	.0910	.0165	.0168	
90,000	59,580	.1110	.0200	.0277	
100,000	66,200	.1367	.0257	.0440	
Load released and rail again reversed in position and loaded on the head at the middle.					
2,000	1,320	0.	0.	0.	Initial load.
10,000	6,620	.0104	.0104	.0011	
20,000	13,240	.0217	.0113	.0022	
30,000	19,860	.0328	.0111	.0031	
40,000	26,480	.0436	.0108	.0043	
50,000	33,100	.0545	.0109	.0058	
60,000	39,720	.0658	.0113	.0075	
70,000	46,340	.0770	.0112	.0097	
80,000	52,960	.0887	.0117	.0125	
90,000	59,580	.1010	.0123	.0158	
100,000	66,200	.1143	.0133	.0198	
Rail again reversed in position, and loaded on the base at the middle.					

No. 15.



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No. 58—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	1,320	0.	0.	0.	Initial load.
10,000	6,620	.0100	.0100	.0010	
20,000	13,240	.0217	.0117	.0019	
30,000	19,860	.0323	.0106	.0029	
40,000	26,480	.0427	.0104	.0039	
50,000	33,100	.0535	.0108	.0054	
60,000	39,720	.0644	.0109	.0072	
70,000	46,340	.0757	.0113	.0093	
80,000	52,960	.0875	.0118	.0124	
90,000	59,580	.1002	.0127	.0164	
100,000	66,200	.1170	.0168	.0238	
Rail removed from machine and middle section of its length about 10″, heated red hot. Allowed to cool gradually until the color had left it, then cooling was hastened with water. Rail reversed in position, loading on the head at the middle.					
2,000	1,320	0.	0.	0.	Initial load.
10,000	6,620	.0098	.0098	.0007	
20,000	13,240	.0207	.0109	.0012	
30,000	19,860	.0311	.0104	.0014	
40,000	26,480	.0407	.0096	.0017	
50,000	33,100	.0505	.0098	.0018	
60,000	39,720	.0597	.0092	.0022	
70,000	46,340	.0690	.0093	.0028	
80,000	52,960	.0790	.0100	.0034	
90,000	59,580	.0890	.0100	.0047	
100,000	66,200	.1000	.0110	.0063	
Reversed in position and loaded on the base at the middle					
2,000	1,320	0.	0.	0.	Initial load.
10,000	6,620	.0100	.0100	.0011	
20,000	13,240	.0219	.0119	.0022	
30,000	19,860	.0328	.0109	.0046	
40,000	26,480	.0437	.0109	.0052	
50,000	33,100	.0542	.0105	.0065	
60,000	39,720	.0640	.0098	.0072	
70,000	46,340	.0736	.0096	.0077	
80,000	52,960	.0834	.0098	.0086	
90,000	59,580	.0934	.0100	.0098	
100,000	66,200	.1043	.0109	.0117	
Rail removed from machine and middle of its length heated to nearly the same temperature as before, and allowed to cool slowly in hot ashes. Test resumed after 16 hours. Reversed in position and loaded on the head at the middle.					
2,000	1,320	0.	0.	0.	Initial load.
10,000	6,620	.0097	.0097	.0005	
20,000	13,240	.0206	.0109	.0007	
30,000	19,860	.0307	.0101	.0010	
40,000	26,480	.0402	.0095	.0011	
50,000	33,100	.0498	.0096	.0013	
60,000	39,720	.0590	.0092	.0015	
70,000	46,340	.0683	.0093	.0017	
80,000	52,960	.0778	.0095	.0024	
90,000	59,580	.0877	.0099	.0035	
100,000	66,200	.0985	.0108	.0052	
Reversed in position and loaded on the base at the middle.					
2,000	1,320	0.	0.	0.	Initial load.
10,000	6,620	.0102	.0102	.0009	
20,000	13,240	.0215	.0113	.0016	
30,000	19,860	.0318	.0103	.0022	
40,000	26,480	.0415	.0097	.0028	
50,000	33,100	.0513	.0098	.0035	
60,000	39,720	.0608	.0095	.0040	
70,000	46,340	.0706	.0098	.0047	
800,00	52,960	.0799	.0093	.0055	
90,000	59,580	.0899	.0100	.0067	
100,000	66,200	.1009	.0110	.0085	
Reversed in position and loaded on the head at the middle.					

No. 58—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	1,320	0.	0.	0.	Initial load.
10,000	6,620	.0100	.0100	.0008	
20,000	13,240	.0211	.0111	.0013	
30,000	19,860	.0317	.0106	.0020	
40,000	26,480	.0417	.0100	.0026	
50,000	33,100	.0518	.0101	.0032	
60,000	39,720	.0615	.0097	.0040	
70,000	46,340	.0712	.0097	.0048	
80,000	52,960	.0810	.0098	.0056	
90,000	59,580	.0908	.0098	.0065	
100,000	66,200	.1012	.0104	.0078	
110,000	72,820	.1135	.0123	.....	
120,000	79,440	.1300	.0165	.....	
130,000	86,060	.2275	.0975	.1015	Scale starts.
Reversed in position and loaded on the base at the middle.					
2,000	1,320	0.	0.	0.	Initial load.
10,000	6,620	.0115	.0115	.0023	
20,000	13,240	.0257	.0142	.0056	
30,000	19,860	.0391	.0134	.0095	
40,000	26,480	.0533	.0142	.0133	
50,000	33,100	.0683	.0150	.0199	
Reversed in position and loaded on the head at the middle.					
2.000	1,320	0.	0.	0.	Initial load.
10,000	6,620	.0099	.0099	.0010	
20,000	13,240	.0216	.0117	.0014	
30,000	19,860	.0315	.0099	.0018	
40,000	26,480	.0421	.0106	.0024	
50,000	33,100	.0520	.0099	.0030	
60,000	39,720	.0615	.0095	.0038	
70,000	46,340	.0719	.0104	.0045	
80,000	52,960	.0820	.0101	.0056	
90,000	59,580	.0925	.0105	.0071	
100,000	66,200	.1040	.0115	.0089	Test discontinued.

No. 78.

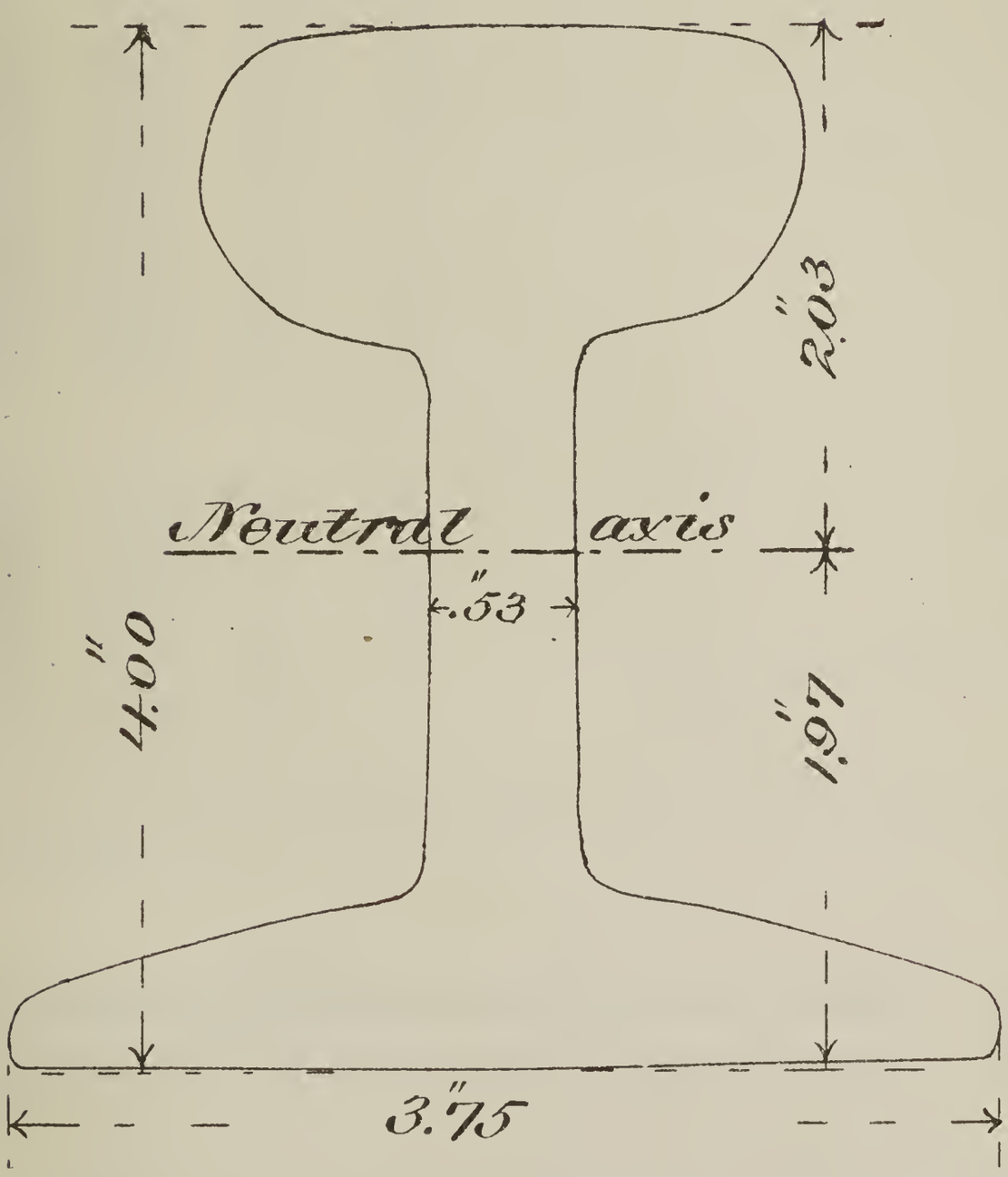
Steel Rail No. 18.

Branded "Barrow Steel 1868 ⁝ · ."
Height, 4″.
Width of base, 3″.75.
Weight per yard, 54.5 pounds.
Supported at ends 30″ apart.
Loaded on head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,750	0.	0.	0.	Initial load.
4,000	5,490	.0052	.0052	.....	
6,000	8,240	.0100	.0048	.....	
8,000	10,980	.0143	.0043	.....	
10,000	13,730	.0185	.0042	.0007	
12,000	16,480	.0238	.0053	.....	
14,000	19,220	.0267	.0029	.....	
16,000	21,970	.0310	.0043	.....	
18,000	24,710	.0352	.0042	.....	
20,000	27,460	.0393	.0041	.0008	
22,000	30,210	.0435	.0042	.....	
24,000	32,950	.0478	.0043	.....	
26,000	35,700	.0523	.0045	.....	

No. 18.

Branded "Barrow Steel 1868 :·"

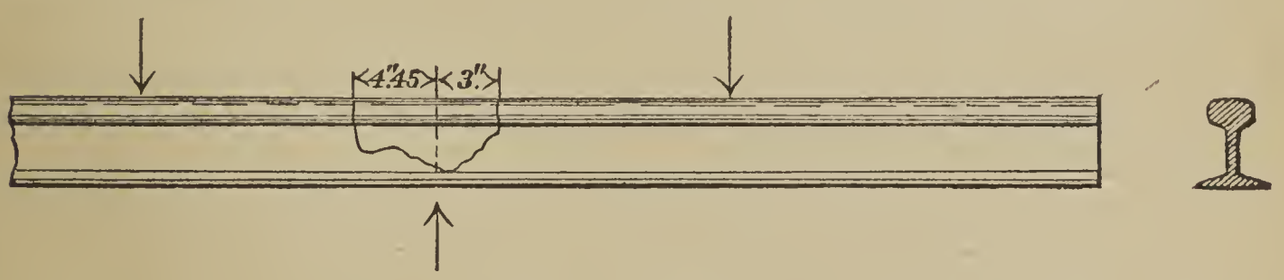


H Ex 161 52 1

No. 78—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inches.*	*Inch.*	*Inch.*	
28,000	38,440	.0559	.0036	.....	E=24,030,000.
30,000	41,190	.0600	.0041	.0009	
32.000	43,940	.0640	.0040	.....	
34,000	46,680	.0680	.0040	.....	
36,000	49,430	.0720	.0040	.....	
38,000	52,170	.0760	.0040	.....	
40,000	54,920	.0801	.0041	.0017	Elastic limit.
42,000	57,670	.0845	.0044	.....	
44,000	60,410	.0892	.0047	.....	
46,000	63,160	.0932	.0040	.....	
48,000	65,900	.0975	.0043	.....	
50,000	68,650	.1025	.0050	.0042	
10,000	13,730	.....	.....	.....	Rested under this load 14 hours.
52,000	71,400	.1062	.0037	.....	
54,000	74,140	.1113	.0051	.....	
56,000	76,890	.1165	.0052	.....	
58,000	79,630	.1228	.0063	.....	
60,000	82,380	.1296	.0068	.0122	
62,000	85,130	.1385	.0089	.....	
64,000	87,870	.1492	.0107	.....	
66,000	90,620	.1832	.0340	.....	
68,000	93,360	.2332	.0500	.....	
70,000	96,110	.3095	.0763	.1668	
72,000	98,860	.37	.0605	.....	
74,000	101,600	.46	.09	.....	Sustained this load 10 minutes.
76,000	104,350	.50	.04	.....	
78,000	107,090	.61	.11	.....	
80,000	109,840	.70	.09	.....	
82,000	112,590	.82	.12	.....	
84,000	115,330	.96	.14	.....	
86,000	118,080	1.10	.14	.....	
88,000	120,820	1.27	.17	.....	
90,000	123,570	1.48	.21	.....	
92,000	126,320	1.78	.30	.....	
94,000	129,060	2.11	.33	.....	
100,000	137,300	.....	.....	2.30	
		Reversed and loaded on base.			
2,000	2,750	0.	0.	0.	Initial load.
20,000	27,460	.09	.09	.....	
30,000	41,190	.14	.05	.....	
40,000	54,920	.24	.10	.....	
50,000	68,650	.37	.13	.....	
60,000	82,380	.57	.20	.....	
70,000	96,110	.76	.19	.....	
80,000	109,840	1.00	.24	.....	
90,000	123,570	1.55	.55	.....	
100,000	137,300	2.47	.92	.....	Rail is now nearly straight along the head.
103,000	141,420	2.99	.52	.....	
103,480	142,080	.....	.....	.....	Ultimate strength.

A piece 7″.45 long was detached from the top of the rail opposite the middle plunger.



Appearance, granular, radiating from the end of the detached piece, which was 3″ from the center of the middle plunger.

There were no indications of shearing effect from wheel pressures at the surface of the head.

No. 79.

Rail No. 18.

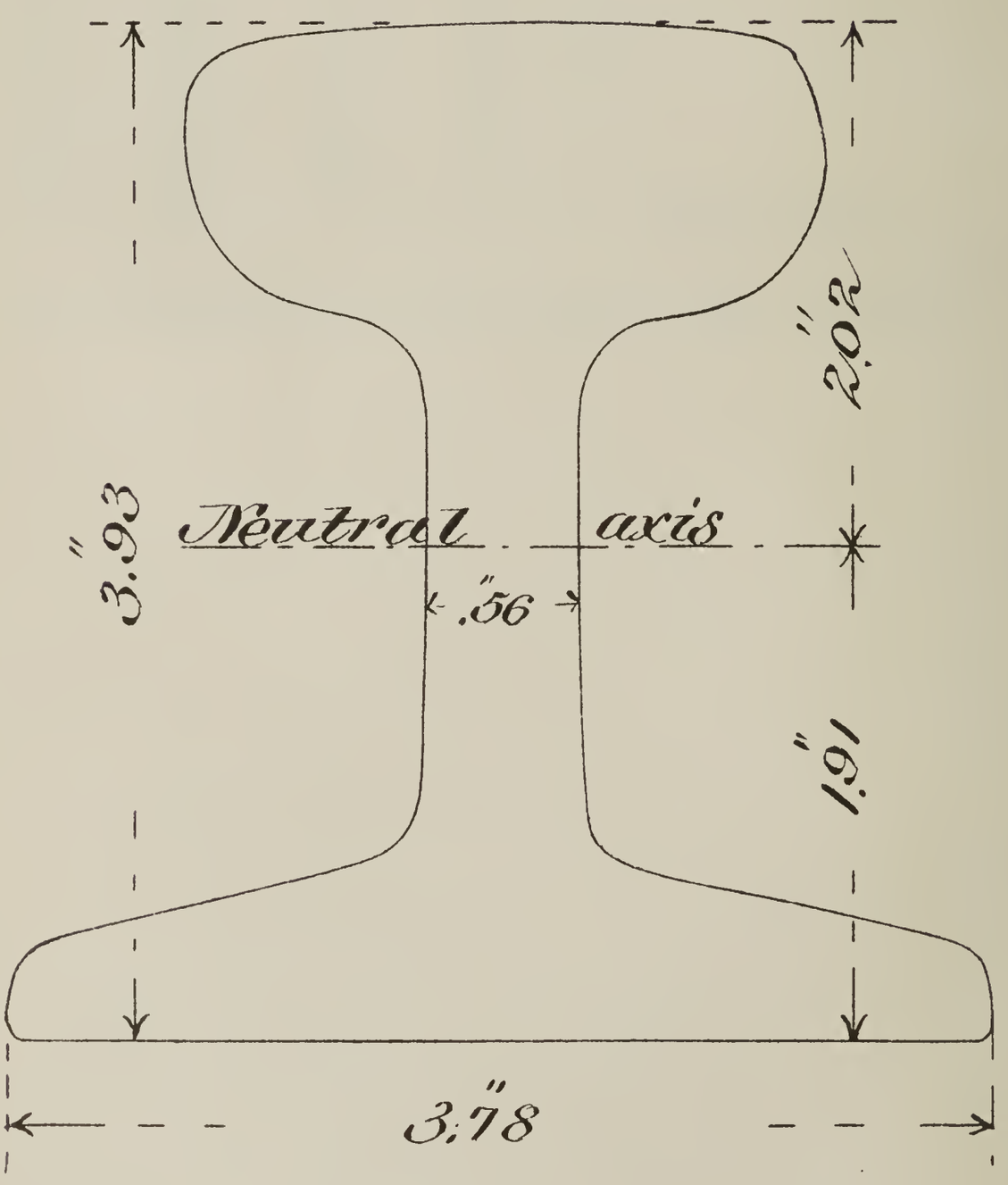
Another section of same rail as No. 78.
Ends supported 30″ apart.
Loaded on base at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inches.*	*Inch.*	*Inch.*	
2,000	2,750	0.	0.	0.	Initial load.
20,000	27,460	.03	.03	.....	
30,000	41,190	.05	.02	.....	
40,000	54,920	.08	.03	.....	
50,000	68,650	.10	.02	.....	
60,000	82,380	.13	.03	.....	
65,000	89,250	.18	.05	.....	
70,000	96,110	.30	.12	.....	
72,000	98,860	.37	.07	.....	
74,000	101,600	.43	.06	.....	
76,000	104,350	.50	.07	.....	
78,000	107,090	.58	.08	.....	
80,000	109,840	.68	.10	.....	
82,000	112,590	.77	.09	.....	
84,000	115,330	.88	.11	.....	
86,000	118,080	1.01	.13	.....	
88,000	120,820	1.15	.14	.....	
90,000	123,570	1.36	.21	.....	
91,850	126,110	.....	.....	.....	Ultimate strength.

Granular appearance, radiating from top surface of the rail.

No. 21

Branded "P S Co 1879"



H Ex 161 52 1

No. 80.

STEEL RAIL NO. 21.

Branded "P. S. Co., 1879."
Height, 3″.93; width of base, 3″.78; weight per yard, 58 pounds.
Ends supported 30″ apart.
Loaded on head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inches.*	*Inch.*	*Inch.*	
2,000	2,570	0.	0.	0.	Initial load.
4,000	5,140	.0053	.0053	.....	
6,000	7,710	.0100	.0047	.....	
8,000	10,280	.0148	.0048	.....	
10,000	12.850	.0191	.0043	.0010	
12,000	15,420	.0238	.0047	.....	
14,000	17,990	.0282	.0044	.....	
16,000	20,560	.0327	.0045	.....	
18,000	23,130	.0370	.0043	.....	
20,000	25,700	.0413	.0043	.0019	
22,000	28,270	.0458	0045	.....	
24,000	30,840	.0503	.0045	.....	
26,000	33,410	.0545	.0042	.....	
28,000	35,980	.0586	.0041	.....	
30,000	38,550	.0630	.0044	.0023	E = 22,010,000.
32,000	41,120	.0670	.0040	.....	
34,000	43,690	.0715	.0045	.....	
36,000	46,260	.0757	.0042	.....	
38,000	48,830	.0798	.0041	.....	
40,000	51,400	.0840	.0042	.0037	Elastic limit.
42,000	53,970	.0885	.0045	.....	
44,000	56,540	.0929	.0044	.....	
46,000	59,110	.0981	.0052	.....	
48,000	61,680	.1043	.0062	.....	
50,000	64,250	.1113	.0070	.0118	
52,000	66,820	.1220	.0107	.....	
54,000	69.390	.1500	.0280	.....	
56,000	71,960	.1880	.0380	.....	
58,000	74,530	.2097	.0217	.....	
60,000	77,100	.2460	.0363	.1240	
62,000	79,670	.27	.0240	.....	
64,000	82,240	.34	.07	.....	
66,000	84,810	.40	.06	.....	
68,000	87,380	.47	.07	.....	
70,000	89,950	.52	.05	.....	
72,000	92,520	.61	.09	.....	
74,000	95,090	.69	.08	.....	
76,000	97,660	.78	.09	.....	
78,000	100,230	.86	.08	.....	
80,000	102,800	.98	.12	.....	
82,000	105,380	1.08	.10	.....	
84,000	107,950	1.21	.13	.....	
86,000	110,520	1.42	.21	.....	
88,000	113,090	.....	.....	.....	Ultimate strength.

Fracture began at lower corner of one flange of the base, 2″ from middle of span, at a place where the metal had been indented ″.08 across the corner.

The fracture was granular, radiating from the indented corner.

At the surface of the head and for a depth of ″.02 to ″.04 the fracture presented a sheared appearance and showed where the metal had flowed laterally under the wheel pressures.

No. 81.

Rail No. 21.

Notch in base of rail, in one flange 1″.40 long in direction of length of rail by ″.83 deep.

This notch was cut in flange, apparently by means of a cold chisel.

Height, 3″.93; width of base adjacent to notch, 3″.78.

Supported at ends 30″ apart.

Loaded on head at the middle at a place opposite to notch in the base.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,570	0.	0.	0.	Initial load.
20,000	25,700	.04	.04	.....	
30,000	38,550	.07	.03	.....	
40,000	51,400	.10	.03	.....	
45,000	57,830	.11	.01	.....	
50,000	64,250	.14	.03	.....	
51,400	66,050	.....	.....	.....	Ultimate strength.

Fracture granular, radiating from the notch in the base. Sheared appearance next surface of the head.

No. 82.

Rail No. 21.

Height, 3″.93; width of base, 3″.78.

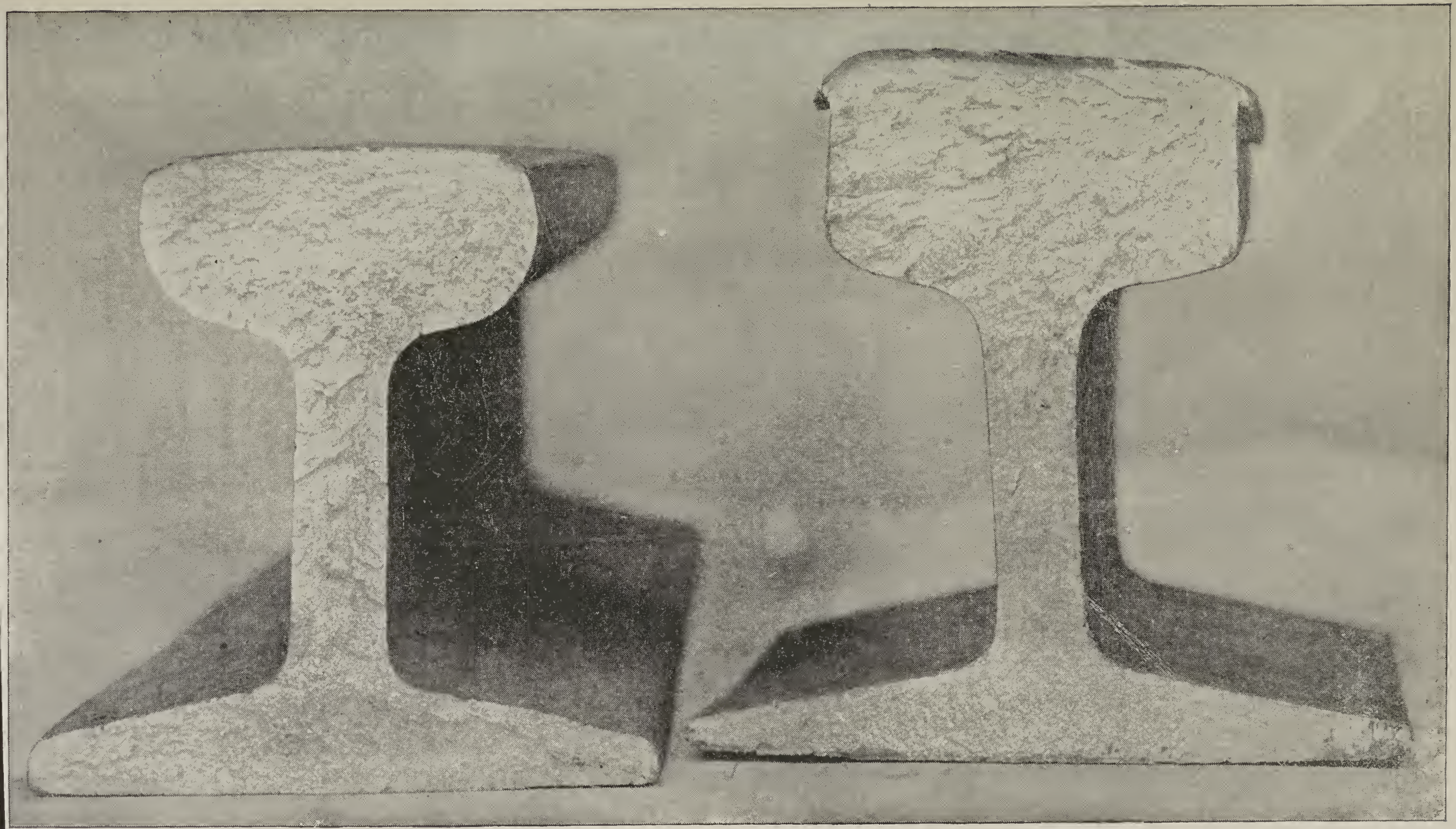
Supported at ends 30″ apart.

Loaded on base at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,570	0.	0.	0.	Initial load.
20,000	25,700	.04	.04	.....	
30,000	38,550	.06	.02	.....	
40,000	51,400	.08	.02	.....	
45,000	57,830	.10	.02	.....	
50,000	64,250	.12	.02	.....	
55,000	70,680	.17	.05	.....	
60,000	77,100	.25	.08	.....	
62,000	79,670	.31	.06	.18	
64,000	82,240	.33	.02	.....	
66,000	84,810	.40	.07	.....	
68,000	87,380	.47	.07	.32	
70,000	89,950	.52	.05	.....	
72,000	92,520	.59	.07	.....	
74,000	95,090	.67	.08	.....	
74,900	96,250	.....	.....	.....	Ultimate strength.

Appearance, granular, radiating from one side of the head.

The metal near the surface of the head showed a sheared appearance to a depth of ″.04 to ″.08, the center of radiation of the granular metal being at the side of the head having the deepest sheared metal.

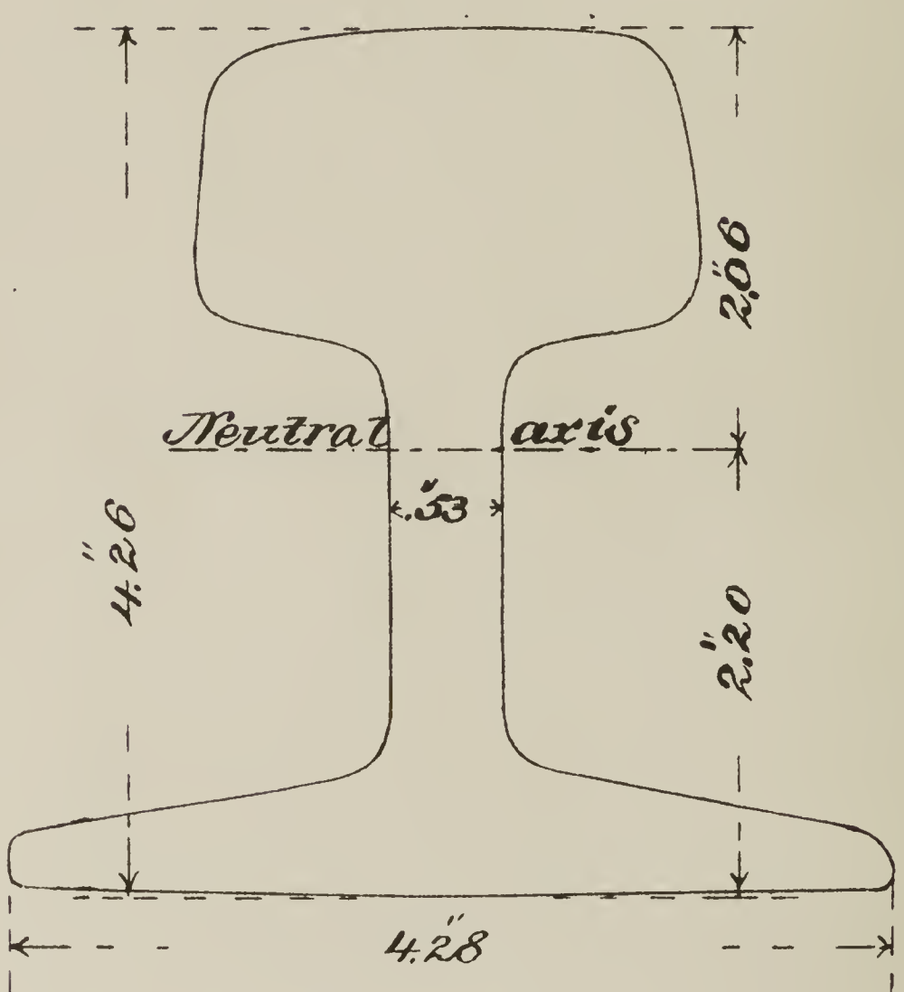


No. 21.

No. 34.

No. 22.

Branded "N A & R I & S C Troy Steel 1883 12"



No. 83.

Steel Rail No. 22.

Branded "12 A & R I & S^{c} Troy Steel 1883 12."
Height, 4″.26; width of base, 4″.28; weight per yard, 65.4 pounds.
Ends supported 30″ apart.
Loaded on head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inches.*	*Inch.*	*Inches.*	
2,000	2,210	0.	0.	0.	Initial load.
4,000	4,420	.0040	.0040	.....	
6,000	6,630	.0077	.0037	.....	
8,000	8,840	.0115	.0038	.....	
10,000	11,060	.0153	.0038	.0003	
12,000	13,270	.0195	.0042	.....	
14,000	15,480	.0229	.0034	.....	
16,000	17,690	.0268	.0039	.....	
18,000	19,900	.0305	.0037	.....	
20,000	22,110	.0340	.0035	.0006	
22,000	24,320	.0373	.0033	.....	
24,000	26,530	.0411	.0038	.....	
26,000	28,740	.0446	.0035	.....	
28,000	30,950	.0480	.0034	.....	
30,000	33,170	.0513	.0033	.0013	
32,000	35,380	.0552	.0039	.....	
34,000	37,590	.0587	.0035	.....	
36,000	39,800	.0624	.0037	.....	
38,000	42,010	.0655	.0031	.....	
40,000	44,220	.0688	.0033	.0026	E = 21,640,000.
42,000	46,430	.0725	.0037	.....	
44,000	48,640	.0765	.0040	.....	
46,000	50,850	.0804	.0039	.....	Elastic limit.
48,000	53,060	.0850	.0046	.....	
50,000	55,280	.0895	.0045	.0075	
52,000	57,500	.0945	.0050	.....	
54,000	59,710	.1018	.0073	.....	
56,000	61,920	.1170	.0152	.....	
58,000	64,130	.1340	.0170	.....	
60,000	66,340	.1750	.0410	.0740	
62,000	68,550	.22	.045	.....	
64,000	70,760	.26	.04	.....	
66,000	72,980	.29	.03	.....	
68,000	75,190	.33	.04	.....	
70,000	77,400	.39	.06	.26	
8,000	8,850	.....	.....	.....	Rested under this load 40 hours.
72,000	79,610	.40	.01	.....	
74,000	81,820	.41	.01	.....	
76,000	84,030	.51	.10	.....	
78,000	86,240	.60	.09	.....	
80,000	88,450	.66	.06	.....	
82,000	90,670	.76	.10	.....	
84,000	92,880	.85	.09	.....	
86,000	95,090	.95	.10	.....	
88,000	97,300	1.05	.10	.....	
90,000	99,510	1.15	.10	.....	
92,000	101,720	1.33	.18	.....	
94,000	103,930	1.46	.13	.....	
96,000	106,150	1.68	.22	.....	
98,000	108,360	1.96	.28	.....	
100,000	110,570	2.26	.30	2.06	
		Reversed and loaded on base.			
2,000	2,210	0.	0.	0.	Initial load.
20,000	22,110	.09	.09	.....	
30,000	33,170	.16	.07	.....	
40,000	44,220	.26	.10	.18	
50,000	55,280	.37	.11	.....	
60,000	66,340	.57	.20	.45	
62,000	68,550	.59	.02	.....	
64,000	70,760	.64	.05	.....	
66,000	72,980	.68	.04	.....	
68,000	75,190	.72	.04	.....	
70,000	77,400	.76	.04	.....	
72,000	79,610	.80	.04	.....	
74,000	81,820	.87	.07	.....	
76,000	84,030	.92	.05	.....	

No. 83—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inches.*	*Inch.*	*Inch.*	
78,000	86,240	.97	.05	.....	Rested under load 15 minutes.
80,000	88,450	.98	.01	.83	
82,000	90,670	1.05	.07	.....	
84,000	92,880	1.08	.03	.....	
86,000	95,090	1.20	.12	.....	
88,000	97,300	1.29	.09	.....	
90,000	99,510	1.37	.08	.....	
92,000	101,720	1.47	.10	.....	
94,000	103,930	1.61	.14	.....	
96,000	106,150	1.71	.10	.....	
97,900	108,250	.....	.....	.....	Ultimate strength.

Fracture granular, radiating from top surface of the head.

At one side of the head the metal presented a sheared appearance and evidence of flow under the wheel pressures. The part thus affected was about ″.15 by ″.04 deep.

No. 84.

Rail No. 22.

Height, 4″.26.
Ends supported 30″ apart.
Loaded on base at middle.

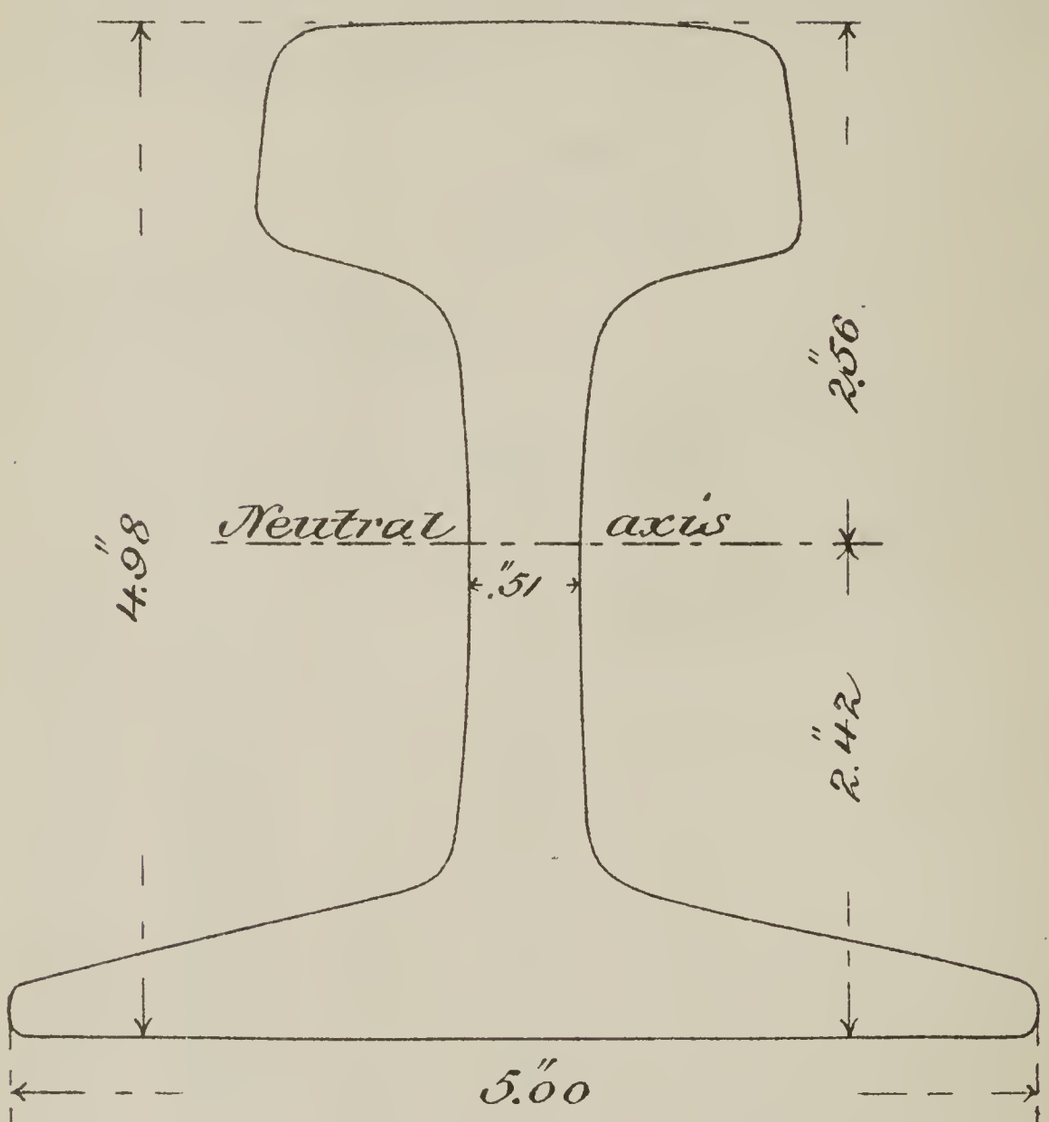
Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inches.*	*Inch.*	*Inch.*	
2,000	2,210	0.	0.	0.	Initial load.
10,000	11,060	.02	.02	.....	
20,000	22,110	.04	.02	.....	
30,000	33,170	.06	.02	.....	
40,000	44,220	.08	.02	.....	
50,000	55,280	.10	.02	.02	
52,000	57,500	.11	.01	.....	
54,000	59,710	.13	.02	.....	
56,000	61,920	.15	.02	.....	
58,000	64,130	.17	.02	.....	
60,000	66,340	.18	.01	.07	
62,000	68,550	.20	.02	.....	
64,000	70,760	.23	.03	.....	
66,000	72,980	.25	.02	.....	
68,000	75,190	.28	.03	.....	
70,000	77,400	.32	.04	.20	
72,000	79,610	.37	.05	.....	
74,000	81,820	.42	.05	.....	
76,000	84,030	.47	.05	.....	
78,000	86,240	.52	.05	.....	
80,000	88,450	.58	.06	.45	
82,000	90,670	.66	.08	.....	
84,000	92,880	.73	.07	.....	
86,000	95,090	.80	.07	.....	
88,000	97,300	.90	.10	.....	
90,000	99,510	1.00	.10	.....	
91,200	100,840	.....	.....	.....	Ultimate strength.

Fractured obliquely across rail, beginning at the surface of the head $2\frac{1}{2}$″ eccentric from the middle bearing, and extending to the base at the middle of the span.

Appearance, granular. At one side of the head the metal presented a sheared appearance, with evidence of slight flow under the wheel pressures.

No. 23.

Branded "Lack^{a} I & C Co Scranton 4-89"



No. 85.

STEEL RAIL NO. 23.

Section of new rail branded "Lack[a] I & C Co., Scranton 4–89."
Height, 4″.98; width of base, 5″; weight per yard, 74.5 pounds.
Ends supported 30″ apart.
Loaded on head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	1,520	0.	0.	0.	Initial load.
10,000	7,620	.0113	.0113	0.	
20,000	15,240	.0230	.0117	.0001	
30,000	22,850	.0348	.0118	.0006	
40,000	30,470	.0459	.0111	.0005	
50,000	38,090	.0573	.0114	.0008	
60,000	45.710	.0662	.0109	.0010	
70,000	53,320	.0770	.0108	.0012	
80,000	60,940	.0880	.0110	.0022	
82,000	62,470	.0903	.0023	.....	
84,000	63,990	.0926	.0023	.....	
86,000	65,510	.0950	.0024	.....	
88,000	67,040	.0975	.0025	.....	Scale starts off web.
90,000	68,560	.1000	.0025	.0043	E=20,530,000.
92,000	70,080	.1032	.0032	.....	
94,000	71,610	.1058	.0026	.....	Elastic limit.
96,000	73,130	.1090	.0032	.....	
98,000	74,650	.1122	.0032	.....	
100,000	76,170	.1163	.0041	.0097	
102,000	77,700	.1206	.0043	.....	
104,000	79,220	.1250	.0044	.....	
106,000	80,740	.1325	.0075	.....	
108,000	82,270	.1493	.0068	.....	
110,000	83,790	.1420	.0027	.0298	Sustained 110,000 momentarily.
112,000	85,320	.1604	.0184	.....	
114,000	86,840	.1702	.0098	.....	
116,000	88,360	.1825	.0123	.....	
118,000	89,890	.1983	.0158	.....	
120,000	91,410	.2230	.0247	.0910	
		Reversed and loaded on base.			
2,000	1,520	0.	0.	0.	Initial load.
10,000	7,620	.0120	.0120	.0024	
20,000	15,240	.0280	.0160	.0062	
30,000	22,850	.0435	.0155	.0108	
40,000	30,470	.0595	.0160	.0170	
50,000	38,090	.0777	.0182	.0252	
60,000	45,710	.0962	.0185	.0330	
70,000	53,320	.1182	.0220	.0449	
80,000	60,940	.1422	.0240	.0585	
90,000	68,560	.1725	.0303	.0722	
100,000	76,170	.2065	.0340	.1007	
		Reversed and loaded on head.			
2,000	1,520	0.	0.	0.	Initial load.
10,000	7,620	.0120	.0120	.0015	
20,000	15,240	.0258	.0138	.0029	
30,000	22,850	.0400	.0142	.0055	
40,000	30,470	.0537	.0137	.0084	
50,000	38,090	.0679	.0142	.0118	
60,000	45,710	.0832	.0153	.0167	
70,000	53,320	.0995	.0163	.0228	
80,000	60,940	.1178	.0183	.0305	
90,000	68,560	.1378	.0200	.0400	
100,000	76,170	.1611	.0233	.0530	Removed from machine.
		Test resumed after a period of rest of 5½ months. Loaded on the base at the middle.			

No. 85—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	1,520	0.	0.	0.	Initial load.
10,000	7,620	.0114	.0114	.0005	
20,000	15,240	.0235	.0121	.0008	
30,000	22,850	.0347	.0112	.0010	
40,000	30,470	.0459	.0112	.0012	
50,000	38,090	.0573	.0114	.0018	
60,000	45,710	.0693	.0120	.0028	
70,000	53,320	.0821	.0128	.0048	
80,000	60,940	.0960	.0139	.0082	
90,000	68,560	.1123	.0163	.0138	
100,000	76,170	.1334	.0211	.0240	
		Reversed and loaded on head.			
2,000	1,520	0.	0.	0.	Initial load.
10,000	7,620	.0134	.0134	.0008	
20,000	15,240	.0275	.0145	.0020	
30,000	22,850	.0405	.0130	.0033	
40,000	30,470	.0535	.0130	.0048	
50,000	38,090	.0665	.0130	.0068	
60,000	45,710	.0798	.0133	.0088	
70,000	53,320	.0935	.0137	.0114	
80,000	60,940	.1072	.0137	.0146	
90,000	68,560	.1217	.0145	.0180	
100,000	76,170	.1360	.0143	.0208	
		Reversed and loaded on the base.			
2,000	1,520	0.	0.	0.	Initial load.
10,000	7,620	.0119	.0119	.0009	
20,000	15,240	.0246	.0127	.0020	
30,000	22,850	.0370	.0124	.0030	
11,000	8,380	.....	.....	.....	Rested 14 hours under this load.
40,000	30,470	.0480	.0110	.0038	
50,000	38,090	.0603	.0123	.0051	
60,000	45,710	.0740	.0137	.0080	
70,000	53,320	.0880	.0140	.0110	
80,000	60,940	.1023	.0143	.0147	
90,000	68,560	.1175	.0152	.0192	
100,000	76,170	.1342	.0167	.0258	

No. 85—Continued.

Rail removed from machine and middle section heated over a length of 10″.

Expansion hot ″.0670 in 6 inches.

Estimated temperature, 1780° F.

Cooled in the open air and then returned to the testing machine and loaded on the head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	1,520	0.	0.	0.	Initial load.
10,000	7,620	.0138	.0138	.0007	
20,000	15,240	.0272	.0134	.0012	
30,000	22,850	.0391	.0119	.0014	
40,000	30,470	.0507	.0116	.0016	
50,000	38,090	.0618	.0111	.0018	
60,000	45,710	.0731	.0113	.0020	
70,000	53,330	.0845	.0114	.0026	
80,000	60,940	.0968	.0123	.0038	
90,000	68,560	.1092	.0124	.0058	
100,000	76,170	.1236	.0144	.0091	
		Reversed and loaded on the base.			
2,000	1,520	0.	0.	0.	Initial load.
10,000	7,620	.0135	.0135	.0008	
20,000	15,240	.0265	.0130	.0017	
30,000	22,850	.0382	.0117	.0025	
40,000	30,470	.0498	.0116	.0033	
50,000	38,090	.0615	.0117	.0043	
60,000	45,710	.0733	.0118	.0051	
70,000	53,320	.0851	.0118	.0063	
80,000	60,940	.0976	.0125	.0084	
90,000	68,560	.1108	.0132	.0110	
100,000	76,170	.1267	.0159	.0160	
		Reversed and loaded on head.			
2,000	1,520	0.	0.	0.	Initial load.
10,000	7,620	.0136	.0136	.0008	
20,000	15,240	.0274	.0138	.0016	
30,000	22,850	.0400	.0126	.0028	
40,000	30,470	.0525	.0125	.0041	
50,000	38,090	.0648	.0123	.0053	
60,000	45,710	.0775	.0127	.0068	
70,000	53,320	.0902	.0127	.0087	
80,000	60,940	.1029	.0127	.0105	
90,000	68,560	.1161	.0132	.0131	
100,000	76,170	.1307	.0146	.0166	
110,000	83,790	.15	.0193	.....	
120,000	91,410	.21	.06	.....	
130,000	99,030	.33	.12	.....	
140,000	106,650	.48	.15	.....	
150,000	114,260	.68	.20	.....	
160,000	121,880	.90	.22	.....	
170,000	129,500	1.19	.29	.98	
		Reversed and loaded on the base.			
2,000	1,520	0.	0.	0.	Initial load.
20,000	15,240	.05	.05	.....	
40,000	30,470	.10	.05	.....	
60,000	45,710	.18	.08	.....	
80,000	60,940	.28	.10	.....	
100,000	76,170	.42	.14	.....	
120,000	91,410	.61	.19	.....	
140,000	106,650	.91	.30	.....	
150,000	114,260	1.11	.20	.....	The rail is now about straight.
160,000	121,880	1.32	.21	.....	
169,200	128,890	.....	.....	.....	Ultimate strength.

Flanges buckled and rail deflected laterally.

No. 60.

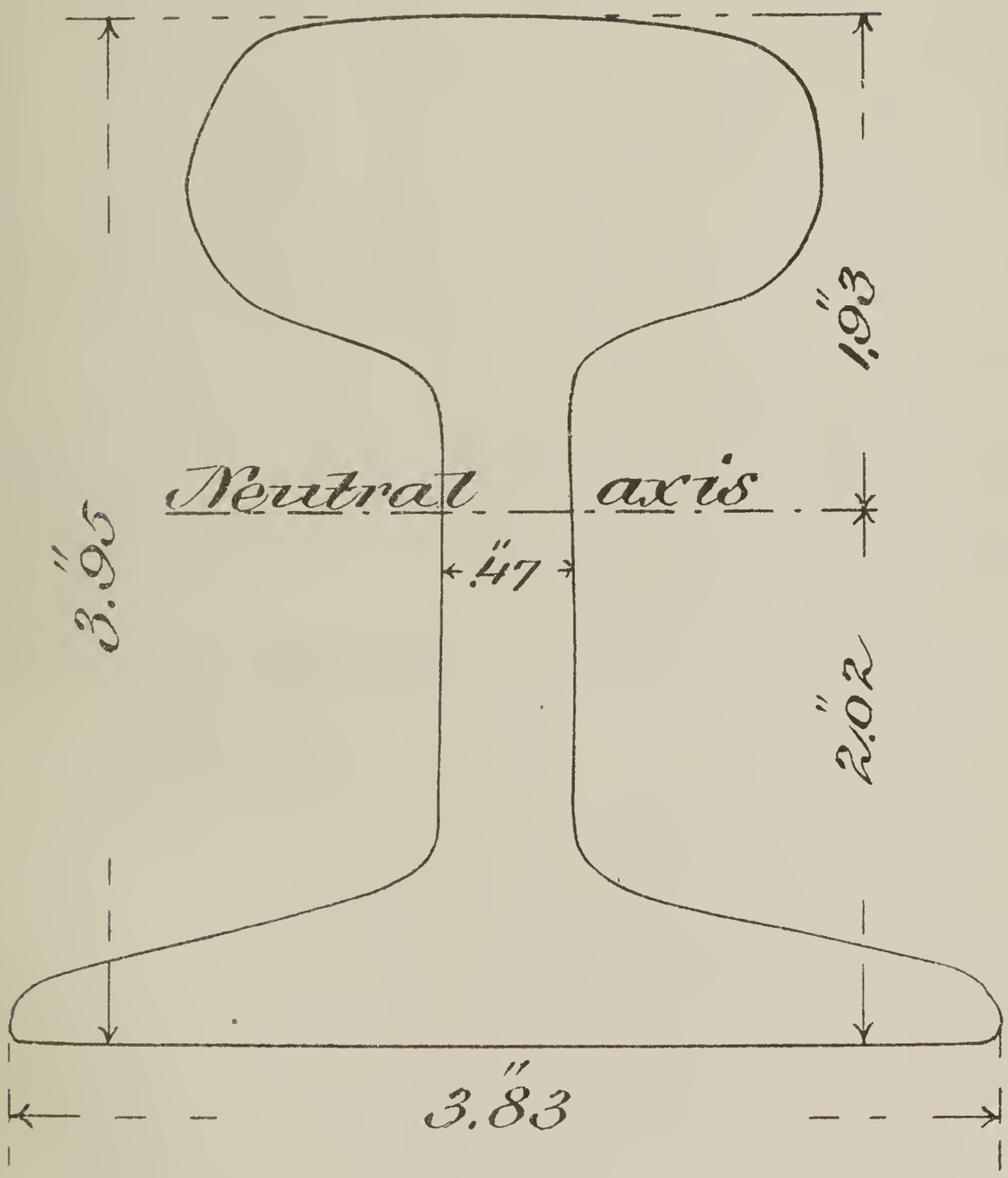
Steel Rail No. 24.

Branded "G. H. Hutte, 1880."
Height, 3″.95.
Width of base, 3″.85.
Ends supported 30″ apart.
Loaded on head at middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,830	0.	0.	0.	Initial load.
4,000	5,660	.0055	.0055	.....	
6,000	8,490	.0097	.0042	.....	
8,000	11,320	.0141	.0044	.....	
10,000	14,150	.0183	.0042	.0010	
12,000	16,980	.0228	.0045	.....	
14,000	19,810	.0273	.0045	.....	
16,000	22,640	.0313	.0040	.....	
18,000	25,470	.0353	.0040	.....	
20,000	28,300	.0393	.0040	.0013	
22,000	31,130	.0435	.0042	.....	
24,000	33,960	.0475	.0040	.....	
26,000	36,790	.0515	.0040	.....	
28,000	39,620	.0555	.0040	.....	
30,000	42,450	.0595	.0040	.0014	
32,000	45,280	.0633	.0038	.....	
34,000	48,110	.0672	.0039	.....	
36,000	50,940	.0711	.0039	.....	
38,000	53,770	.0752	.0041	.....	
40,000	56,600	.0793	.0041	.0018	
42,000	59,430	.0835	.0042	.....	
44,000	62,260	.0874	.0039	.....	
46,000	65,090	.0914	.0040	.....	
48,000	67,920	.0960	.0046	.....	
50,000	70,750	.1004	.0044	.0038	E=26,100,000
52,000	73,580	.1044	.0040	.....	Elastic limit.
54,000	76,410	.1091	.0047	.....	
56,000	79,230	.1147	.0056	.....	
58,000	82,060	.1226	.0079	.....	
60,000	84,890	.1364	.0138	.0204	
62,000	87,720	.1617	.0253	.....	
64,000	90,550	.1980	.0363	.....	
66,000	93,380	.2610	.0630	.....	
68,000	96,210	.3105	.0490	.....	
70,000	99,040	.3675	.0570	.....	
72,000	101,870	.4345	.0670	.....	Rested under load 30 minutes.
74,000	104,700	.4486	.0741	.....	
76,000	107,530	.5828	.1342	.....	
78,000	110,360	.6956	.1128	.....	
80,000	113,190	.8135	.1179	.....	
82,000	116,020	.9554	.1419	.7815	Test discontinued.

No. 24.

Branded "G. H. Hutte 1880."



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No. 91.

Rail No. 24.

Branded "G. H. Hutte, 1880."
Height, 3″.95.
Width of base, 3″.83. Weight per yard, 56.6 pounds.
Ends supported 24″ apart.
Loaded on the base at middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,260	0.	0.	0.	Initial load.
10,000	11,320	.0124	.0124	.0010	
20,000	22,640	.0252	.0128	.0013	
30,000	33,960	.0377	.0125	.0017	
40,000	45,280	.0497	.0120	.0018	
50,000	56,600	.0620	.0123	.0025	
52,000	58,860	.0645	.0025	----------	
54,000	61,120	.0670	.0025	----------	
56,000	63,390	.0694	.0024	----------	
58,000	65,650	.0721	.0027	----------	
60,000	67,910	.0748	.0027	.0043	E = 22,130,000.
62,000	70,180	.0778	.0030	----------	
64,000	72,440	.0808	.0030	----------	Elastic limit.
66,000	74,710	.0842	.0034	----------	
68,000	76,970	.0882	.0040	----------	
70,000	79,230	.0927	.0045	.0112	
72,000	81,500	.0990	.0063	----------	Scale starts off web.
74,000	83,760	.1067	.0077	----------	
76,000	86,020	.1165	.0098	----------	
78,000	88,290	.1257	.0092	----------	
79,800	90,330	----------	----------	----------	Ultimate strength.

Fractured suddenly without warning. Appearance, granular. At the surface of the head there appeared a thin layer of metal ″.01 to ″.02 in depth, having a smooth oblique surface of fracture.

There was a dark-colored spot ″.25 long and ″.06 maximum depth, also two other smaller dark-colored spots, all located next the top surface of the head.

These dark-colored spots indicated the presence of incipient cracks, which were present before the test began.

No. 61.

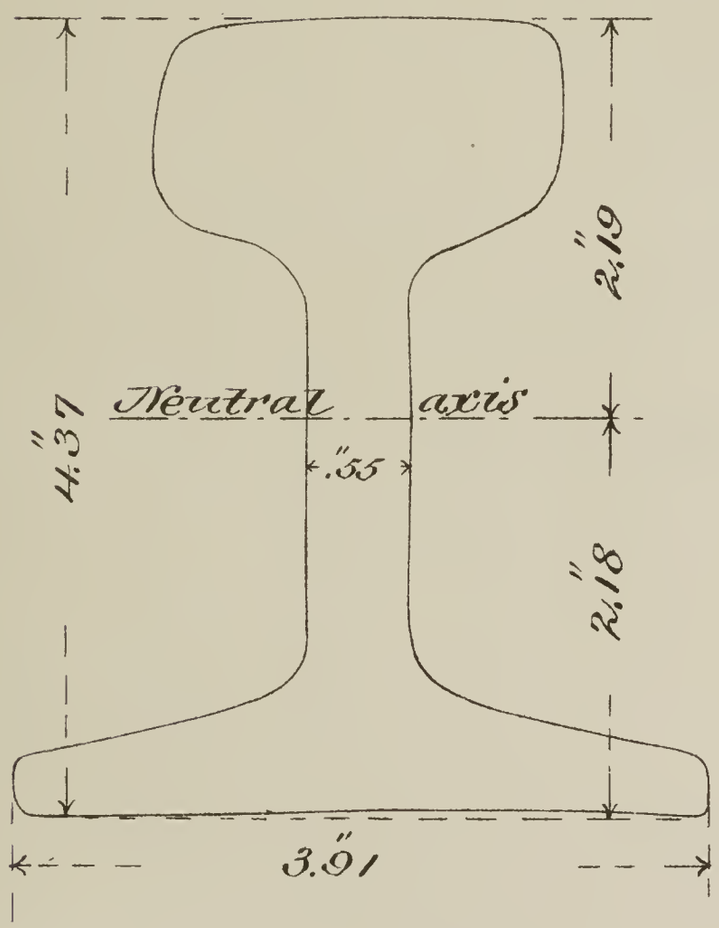
STEEL RAIL NO. 25.

Branded "Cammel Sheffield Toughened Steel, 1873."
Height, 4″.37.
Width of base, 3″.91.
Weight per yard, 60 pounds.
Ends supported 30″ apart.
Loaded on head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,230	0.	0.	0.	Initial load.
4,000	4,450	.0039	.0039	.....	
6,000	6,680	.0077	.0038	.....	
8,000	8,910	.0111	.0034	.....	
10,000	11,130	.0149	.0038	.0012	
12,000	13,360	.0186	.0037	.....	
14,000	15,590	.0220	.0034	.....	
16,000	17,810	.0254	.0034	.....	
18,000	20,040	.0288	.0034	.....	
20,000	22,270	.0321	.0033	.0017	
22,000	24,490	.0365	.0044	.....	
24,000	26,720	.0396	.0031	.....	
26,000	28,950	.0428	.0032	.....	
28,000	31,180	.0460	.0032	.....	
30,000	33,400	.0490	.0030	.0032	E=23,310,000.
32,000	35,630	.0533	.0043	.....	
34,000	37,860	.0563	.0030	.....	
36,000	40,080	.0597	.0034	.....	
38,000	42,310	.0628	.0031	.....	
40,000	44,540	.0662	.0034	.0055	Elastic limit.
42,000	46,760	.0698	.6036	.....	
44,000	48,990	.0736	.0038	.....	
46,000	51,220	.0777	.0041	.....	
48,000	53,450	.0821	.0044	.....	
50,000	55,670	.0867	.0046	.0107	
52,000	57,900	.0917	.0050	.....	
54,000	60,130	.0988	.0071	.....	
56,000	62,350	.1076	.0088	.....	
58,000	64,580	.1206	.0130	.....	
60,000	66,810	.1451	.0245	.0537	
10,000	11,130	.....	.....	.....	Rested under load 15 hours.
62,000	69,030	.1653	.0202	.....	
64,000	71,260	.2210	.0557	.....	
66,000	73,490	.2760	.0550	.....	
68,000	75,710	.3310	.0550	.....	
70,000	77,940	.3910	.0600	.....	
72,000	80,170	.4535	.0625	.....	
74,000	82,400	.5230	.0695	.....	
76,000	84,620	.5933	.0703	.....	
78,000	86,850	.6990	.1057	.....	
80,000	89,080	.8118	.1128	.....	
82,000	91,300	.9302	.1184	.....	Test discontinued.

No. 25.

Branded Cammel Sheffield Toughened Steel 1873".



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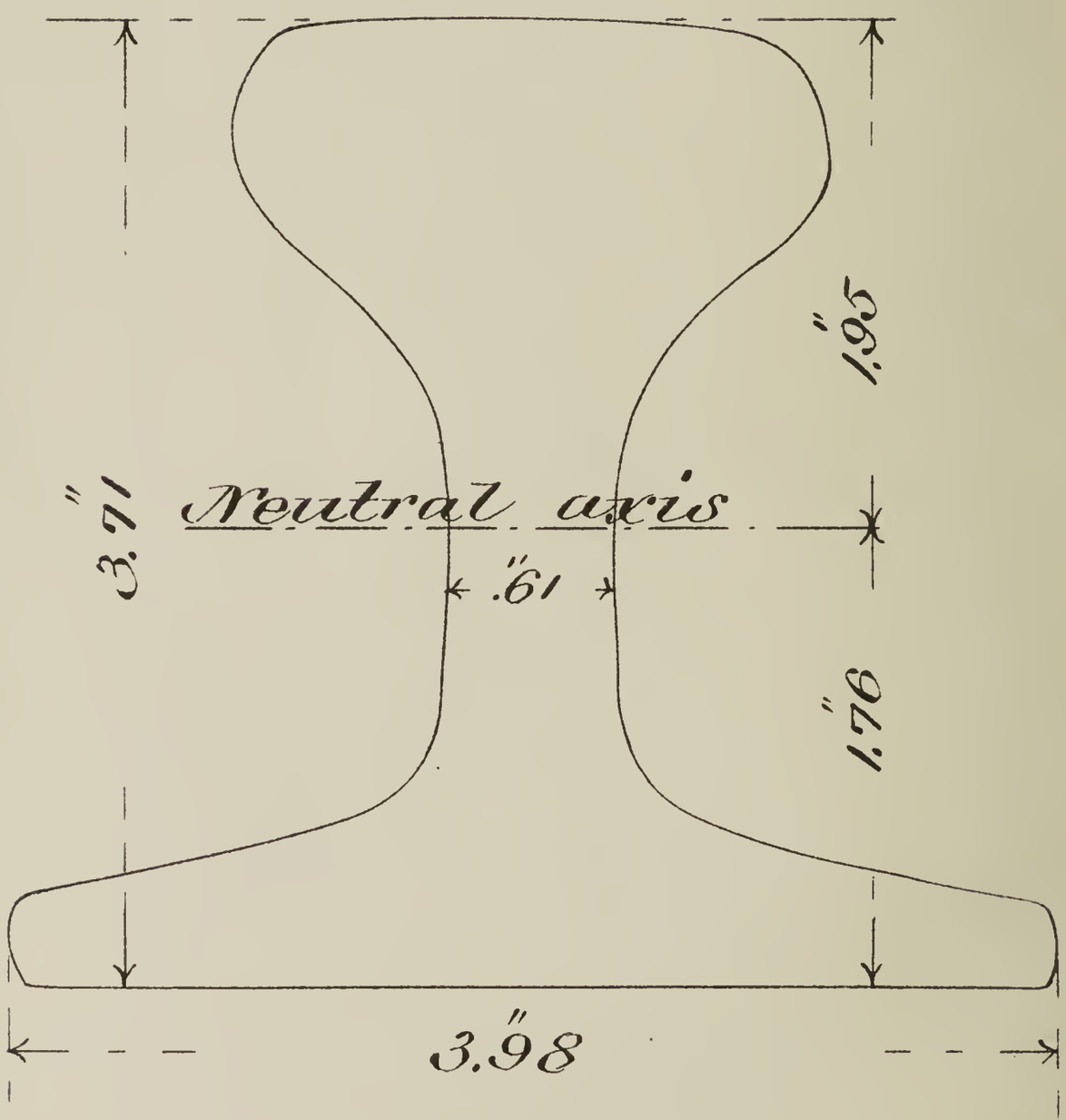

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No. 94.

Rail No. 25.

Height, 4″.37.
Width of base, 3″.91.
Ends supported 22″.1 apart. Loaded on head at the middle.
Ultimate strength, 133,000 pounds.
R=109,090 pounds per square inch. Rail bent 27 degrees without fracture.

No. 62.

Steel Rail No. 26.

Paint marks on head, "22–8."
Height, 3″.71.
Width of base, 3″.98.
Weight per yard, 56.1 pounds.
Ends supported 30″ apart.
Loaded on head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	3,000	0.	0.	0.	Initial load.
4,000	6,000	.0063	.0063	.....	
6,000	8,990	.0102	.0039	.....	
8,000	11,990	.0152	.0050	.....	
10,000	14,990	.0202	.0050	.0002	
12,000	17,990	.0251	.0049	.....	
14,000	20,980	.0300	.0049	.....	
16,000	23,980	.0350	.0050	.....	
18,000	26,980	.0398	.0048	.....	
20,000	29,980	.0448	.0050	.0003	
22,000	32,970	.0494	.0046	.....	
24,000	35,970	.0542	.0048	.....	
26,000	38,970	.0591	.0049	.....	
28,000	41,970	.0640	.0049	.....	
30,000	44,970	.0690	.0050	.0021	E=24,130,000.
32,000	47,960	.0743	.0053	.....	Elastic limit.
34,000	50,960	.0801	.0058	.....	
36,000	53,960	.0867	.0066	.....	
38,000	56,960	.0933	.0066	.....	
40,000	59,950	.1015	.0082	.0120	
42,000	62,950	.1140	.0125	.....	
44,000	65,950	.1500	.0360	.....	
46,000	68,950	.2599	.1099	.....	
48,000	71,940	.3621	.1022	.....	
50,000	74,940	.5898	.2277	.....	
52,000	77,940	.6570	.0672	.....	
54,300	81,390	.9910	.3340	.....	Test discontinued.

No. 63.

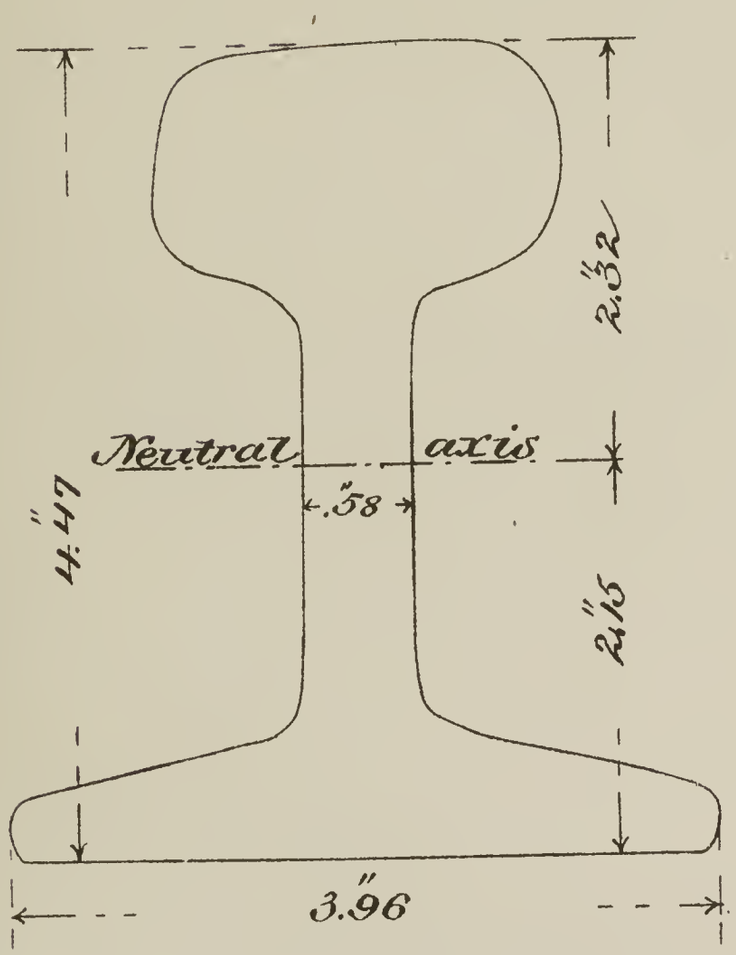
Steel Rail No. 27.

Branded "John Brown & Co., Sheffield, Atlas Steel $\frac{7}{74}$ Sec. 68."
Height, 4″.47.
Width of base, 3″.96.
Weight per yard, 64.19 pounds.
Ends supported 30″ apart.
Loaded on head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,130	0.	0.	0.	Initial load.
4,000	4,270	.0045	.0045	.....	
6,000	6,400	.0082	.0037	.....	
8,000	8,540	.0120	.0038	.....	
10,000	10,670	.0151	.0031	.0012	
12,000	12,800	.0183	.0032	.....	
14,000	14,940	.0218	.0035	.....	
16,000	17,070	.0251	.0033	.....	
18,000	19,200	.0284	.0033	.....	
20,000	21,340	.0316	.0032	.0019	
22,000	23,470	.0350	.0034	.....	
24,000	25,610	.0380	.0030	.....	
26,000	27,740	.0412	.0032	.....	
28,000	29,870	.0447	.0035	.....	
30,000	32,010	.0477	.0030	.0024	
32,000	34,140	.0502	.0025	.....	
34,000	36,270	.0532	.0030	.....	
36,000	38,410	.0567	.0035	.....	
38,000	40,540	.0596	.0029	.....	
40,000	42,680	.0630	.0034	.0035	E=22,030,000.
42,000	44,810	.0663	.0033	.....	
44,000	46,940	.0693	.0030	.....	
46,000	49,080	.0729	.0036	.....	
48,000	51,210	.0767	.0038	.....	
50,000	53,340	.0800	.0033	.0062	Elastic limit.
52,000	55,480	.0841	.0041	.....	
54,000	57,610	.0880	.0039	.....	
56,000	59,750	.0924	.0044	.....	
58,000	61,880	.0964	.0040	.....	
60,000	64,010	.1017	.0053	.0136	
62,000	66,150	.1098	.0081	.....	
64,000	68,280	.1190	.0092	.....	
66,000	70,420	.1458	.0268	.....	
68,000	72,550	.1860	.0402	.....	
70,000	74,680	.2415	.0555	.1389	
30,000	32,010	.1838	—.0577	.....	Rested under load.
17,000	18,140	.....	.....	.....	Load at expiration of 40 hours.
30,000	32,010	.1833	—.0005	.....	
66,000	70,420	.2351	.0518	.....	
68,000	72,550	.2382	.0031	.....	
70,000	74,680	.2413	.0031	.....	
72,000	76,820	.2453	.0040	.....	
73,000	77,890	.2486	.0033	.....	
74,000	78,950	.2852	.0366	.....	
75,000	80,020	.3820	.0968	.....	
76,000	81,090	.3882	.0062	.....	
77,000	82,150	.4020	.0138	.....	
78,000	83,220	.4580	.0560	.....	
80,000	85,350	.5271	.0691	.....	
82,000	87,490	.5831	.0560	.....	
84,000	89,620	.6690	.0859	.....	
86,000	91,760	.7558	.0868	.....	
88,000	93,890	.8698	.1140	.....	
90,000	96,020	.9572	.0874	.8121	Test discontinued.

No. 27.

"John Brown & Co. Sheffield, Atlas Steel 7/74 Sec 68"



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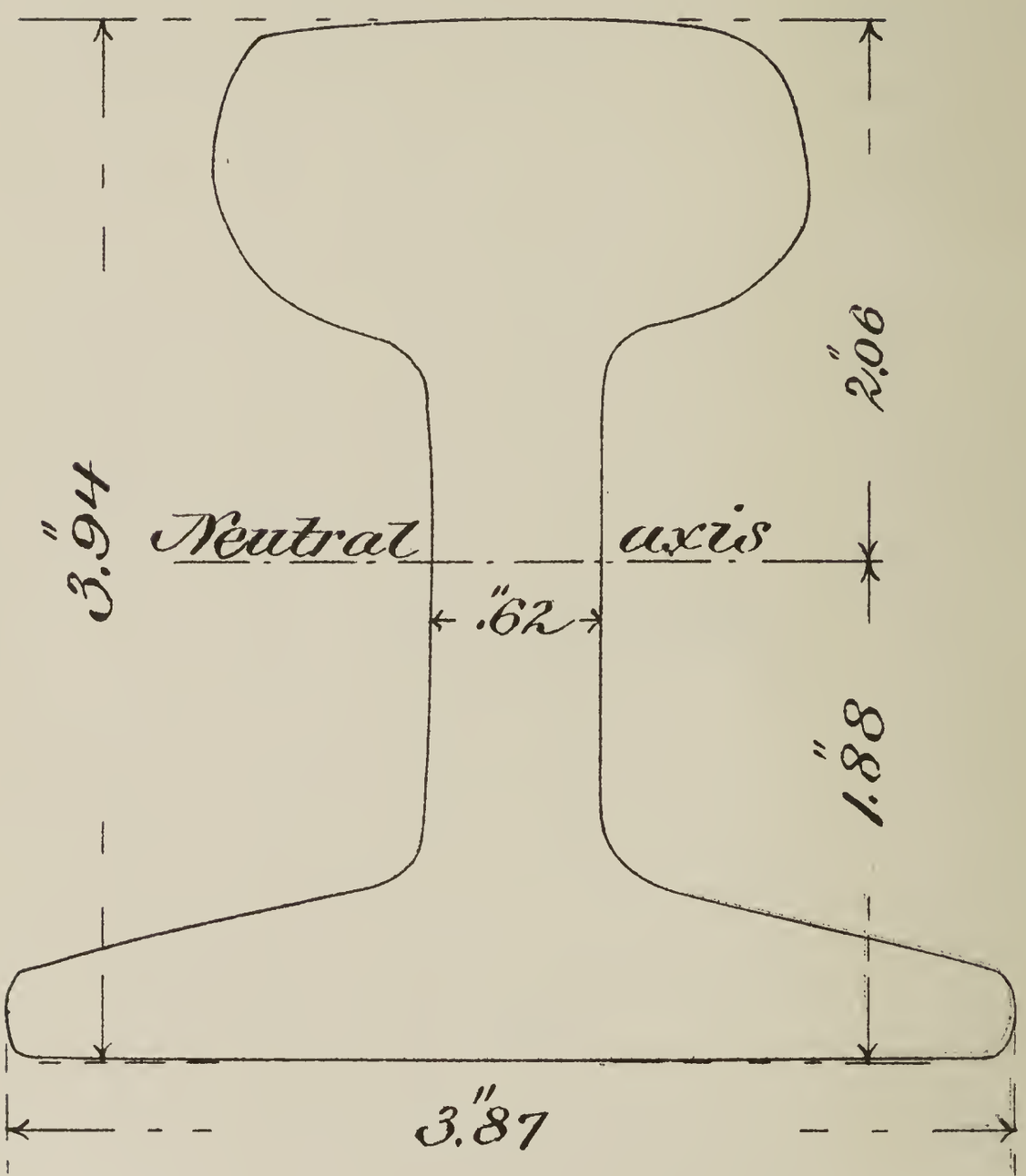
No. 29.



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No. 64.

Old Steel Rail No. 29.

No brand.
Height, 3″.94.
Width of base, 3″.87.
Weight per yard, 41.4 pounds.
Ends supported 30″ apart.
Loaded on base at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,760	0.	0.	0.	Initial load.
4,000	5,530	.0060	.0060	.....	
6,000	8,290	.0110	.0050	.....	
8,000	11,060	.0160	.0050	.....	
10,000	13,820	.0206	.0046	—.0003	
12,000	16,580	.0250	.0044	.....	
14,000	19,350	.0298	.0048	.....	
16,000	22,110	.0339	.0041	.....	
18,000	24,880	.0381	.0042	.....	
20,000	27,640	.0425	.0044	—.0008	
22,000	30,410	.0467	.0042	.....	
24,000	33,170	.0510	.0043	.....	
26,000	35,930	.0556	.0046	.....	
28,000	38,700	.0600	.0044	.....	
30,000	41,460	.0660	.0060	+.0026	
Load released and rail reversed in position, now loading the head at the middle.					
2,000	2,760	0.	0.	0.	Initial load.
4,000	5,530	.0061	.0061	.....	
6,000	8,290	.0120	.0059	.....	
8,000	11,060	.0177	.0057	.....	
10,000	13,820	.0230	.0053	.0031	
12,000	16,580	.0287	.0057	.....	
14,000	19,350	.0338	.0051	.....	
16,000	22,110	.0385	.0047	.....	
18,000	24,880	.0432	.0047	.....	
20,000	27,640	.0481	.0049	.0051	E = 21,070,000.
22,000	30,410	.0533	.0052	.....	
24,000	33,170	.0581	.0048	.....	
26,000	35,930	.0630	.0049	.....	
28,000	38,700	.0681	.0051	.....	
30,000	41,460	.0732	.0051	.0080	Elastic limit.
32,000	44,230	.0791	.0059	.....	
34,000	46,990	.0853	.0062	.....	
36,000	49,750	.0940	.0087	.....	
38,000	52,520	.1120	.0180	.....	
40,000	55,280	.1428	.0308	.0567	
42,000	58,050	.1880	.0452	.....	
44,000	60,810	.2520	.0640	.....	
46,000	63,580	.3315	.0795	.....	
48,000	66,340	.4090	.0775	.....	
50,000	69,100	.4932	.0842	.3840	
Load released and rail again reversed in position, now being brought back to position first occupied, loading the base at the middle.					
2,000	2,760	0.	0.	0.	Initial load.
4,000	5,530	.0079	.0079	.....	
6,000	8,290	.0158	.0079	.....	
8,000	11,060	.0232	.0074	.....	
10,000	13,820	.0310	.0078	.0104	
12,000	16,580	.0390	.0080	.....	
14,000	19,350	.0472	.0082	.....	
16,000	22,110	.0562	.0090	.....	
18,000	24,880	.0670	.0108	.....	
20,000	27,640	.0783	.0113	.0362	
10,000	13,820	.....	.....	.....	Rested under load 15 hours.
20,000	27,640	.0770	—.0013	.....	
21,000	29,020	.0790	.0020	.....	
22,000	30,410	.0815	.0025	.....	
23,000	31,790	.0840	.0025	.....	
24,000	33,170	.0872	.0032	.....	

No. 64—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
25,000	34.550	.0912	.0040	.....	
26,000	35,930	.1020	.0108	.....	
27,000	37,320	.1139	.0119	.....	
28,000	38,700	.1225	.0086	.....	
29,000	40,080	.1310	.0085	.....	
30,000	41,460	.1428	.0118	.0802	
32,000	44,230	.1640	.0212	.....	
34,000	46,990	.1888	.0248	.....	
36,000	49,750	.2118	.0230	.....	
38,000	52,520	.2440	.0322	.....	
40,000	55,280	.2740	.0300	.1904	
42,000	58,050	.3097	.0357	.....	
44,000	60,810	.3544	.0447	.....	
46,000	63,580	.4048	.0504	.....	
48,000	66,340	.4583	.0535	.....	
50,000	69,100	.5340	.0757	.4268	Rail nearly straight.
		Load released, rail reversed and loaded on head at the middle.			
2,000	2,760	0.	0.	.0	Initial load.
4,000	5,530	.0089	.0089	.....	
6,000	8,290	.0161	.0072	.....	
8,000	11,060	.0232	.0071	.....	
10,000	13,820	.0307	.0075	.0120	
12,000	16,580	.0380	.0073	.....	
14,000	19,350	.0451	.0071	.....	
16,000	22,110	.0533	.0082	.....	
18,000	24,880	.0605	.0072	.....	
20,000	27,640	.0693	.0088	.0272	
		Rail removed from machine and set aside for a period of rest without load. Test resumed after resting a period of 4 months. Load applied to the head at the middle.			
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0177	.0177	.0002	
20,000	27,640	.0393	.0216	.0005	
21,000	29,020	.0415	.0022	.....	
22,000	30,410	.0438	.0023	.....	
23,000	31,790	.0460	.0022	.....	
24,000	33,170	.0481	.0021	.....	
25,000	34,550	.0508	.0027	.0012	
26,000	35,930	.0535	.0017	.....	
27,000	37.320	.0548	.0023	.....	
28,000	38,700	.0573	.0025	.....	
29,000	40,080	.0597	.0024	.....	
30,000	41,460	.0628	.0031	.0027	
		Reversed and loaded on base.			
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0190	.0190	.0011	
20,000	27,640	.0409	.0219	.0020	
30,000	41,460	.0632	.0223	.0029	
35,000	48,370	.0750	.0118	.0036	
		Reversed and loaded on the head.			
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0190	.0190	.0015	
20,000	27,640	.0422	.0232	.0026	
30,000	41,460	.0658	.0236	.0053	
		Reversed and loaded on the base.			
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0191	.0191	.0015	
20,000	27,640	.0418	.0227	.0023	
30,000	41,460	.0645	.0227	.0040	
		Reversed and loaded on head.			

No. 64—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inches.*	*Inch.*	*Inch.*	
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0190	.0190	.0012	
20,000	27,640	.0420	.0230	.0026	
30,000	41,460	.0650	.0230	.0043	
31,000	42,840	.0678	.0028	----------	
32,000	44,230	.0711	.0033	----------	
33,000	45,610	.0758	.0047	----------	
34,000	46,990	.0820	.0062	----------	
35,000	48,370	.0893	.0073	.0179	
			Reversed and loaded on base.		
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0183	.0183	.0012	
20,000	27,640	.0421	.0238	.0031	
30,000	41,460	.0685	.0264	.0072	
35,000	48,370	.0825	.0140	.0106	
			Reversed and loaded on head.		
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0200	.0200	.0017	
20,000	27,640	.0442	.0242	.0043	
30,000	41,460	.0702	.0260	.0090	
35,000	48,370	.0878	.0176	.0157	
36,000	49,750	.0935	.0057	----------	
37,000	51,140	.0997	.0062	----------	
38,000	52,520	.1113	.0116	----------	
39,000	53,900	.1211	.0098	----------	
40,000	55,280	.1325	.0114	.0486	
42,000	58,050	.1563	.0238	----------	
44,000	60,810	.1854	.0291	----------	
46,000	63,580	.2166	.0312	----------	
48,000	66,340	.2570	.0404	----------	
50,000	69,100	.3038	.0468	.1950	
			Reversed and loaded on base.		
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0232	.0232	.0057	
20,000	27,640	.0577	.0355	.0178	
30,000	51,460	.1043	.0466	.0423	
40,000	55,280	----------	----------	----------	Load applied and released.
			Reversed and loaded on head.		
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0202	.0202	.0027	
20,000	27,640	.0477	.0275	.0083	
30,000	41,460	.0818	.0341	.0194	
40,000	55,280	.1268	.0450	.0416	
50,000	69,100	.2122	.0854	.1027	
			Reversed and loaded on base.		
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0237	.0237	.0058	
20,000	27,640	.0578	.0341	.0183	
30,000	41,460	.1015	.0437	.0395	
40,000	55,280	.1730	.0715	.0878	
50,000	69,100	.3050	.1320	.1963	Micrometer readings suspended.
			Reversed and loaded on head.		
2,000	2,760	0.	0.	0.	Initial load.
50,000	69,100	.30	.30	----------	
55,000	76,010	.42	.12	----------	
60,000	82,920	.72	.30	----------	
65,000	89,830	1.07	.35	.91	
			Reversed and loaded on base.		

No. 64—Continued.

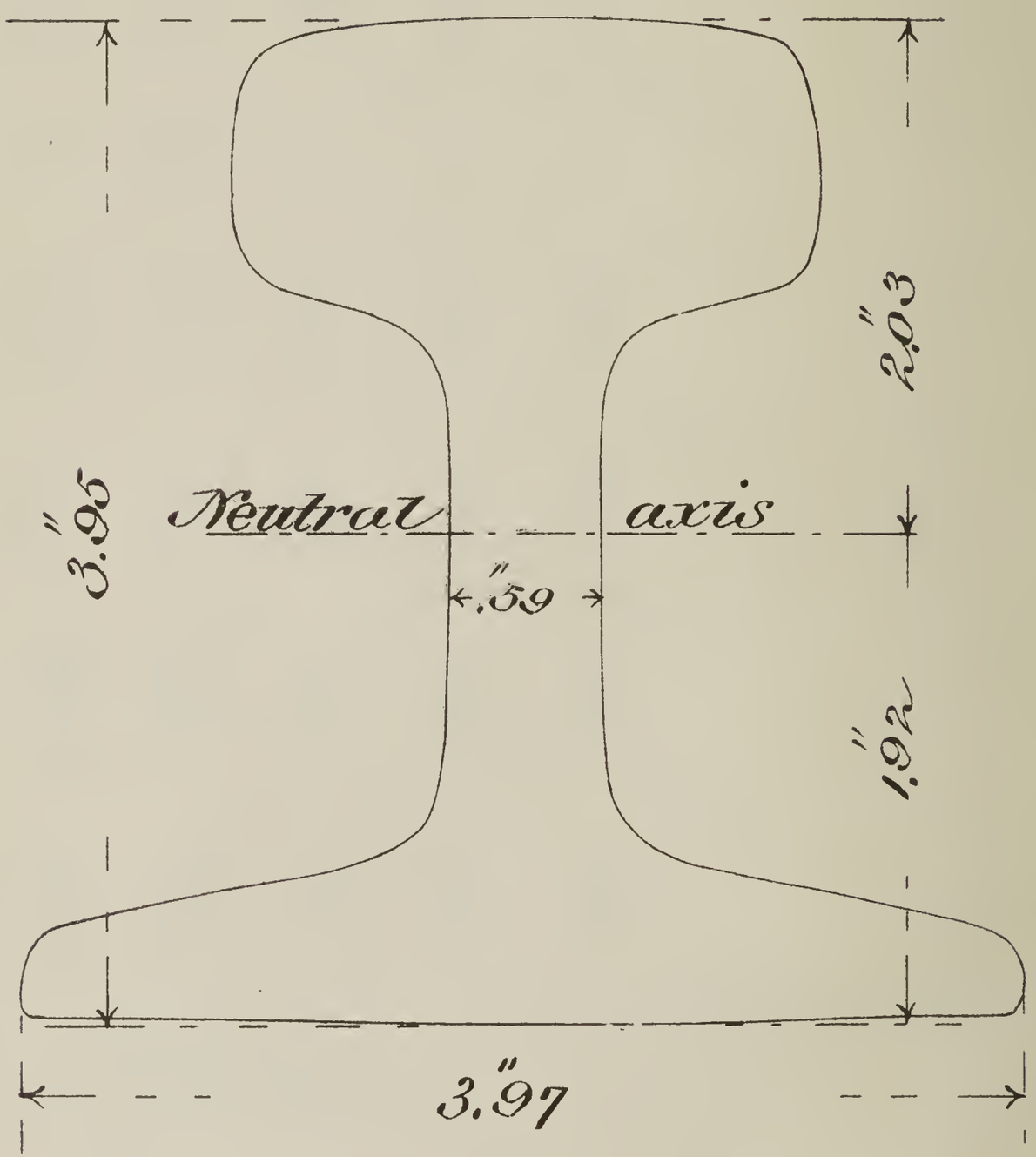
Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inches.*	*Inch.*	*Inches.*	
2,000	2,760	0.	0.	0.	Initial load.
50,000	69,100	.52	.52	.....	
55,000	76,010	.70	.18	.....	
60,000	82,920	.97	.27	.....	Rail nearly straight under this load.
63,000	87,070	1.20	.23	1.06	
The rail is now convex on the head about ".11 on chord of 30". Micrometer readings resumed, setting the instrument at zero under the initial load. Loads applied to the base the same as during the last loading.					
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0182	.0182	.....	
20,000	27,640	.0415	.0233	.....	
30,000	41,460	.0645	.0230	.0012	
40,000	55,280	.0880	.0235	.....	
50,000	69,100	.1120	.0240	.0030	
Reversed and loaded on head.					
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0275	.0275	.0090	
20,000	27,640	.0687	.0412	.0278	
Reversed and loaded on base.					
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0193	.0193	.0015	
20,000	27,640	.0430	.0237	.0025	
30,000	41,460	.0677	.0247	.0043	
40,000	55,280	.0940	.0263	.0079	
50,000	69,100	.1240	.0300	.0147	
Reversed and loaded on head.					
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0228	.0228	.0043	
20,000	27,640	.0552	.0324	.0140	
30,000	41,460	.1065	.0513	.0437	
40,000	55,280	.2002	.0937	.1136	
50,000	69,100	.3747	.1745	.2640	
Reversed and loaded on base.					
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0235	.0235	.0045	
20,000	27,640	.0550	.0315	.0138	
30,000	41,460	.0933	.0383	.0295	
40,000	55,280	.1459	.0526	.0593	
50,000	69,100	.2340	.0881	.1237	
Reversed and loaded on head.					
2,000	2,760	0.	0.	0.	Initial load.
10,000	13,820	.0220	.0220	.0044	
20,000	27,640	.0533	.0313	.0137	
30,000	41,460	.0953	.0420	.0319	
40,000	55,280	.1493	.0540	.0636	
50,000	69,100	.2704	.1211	.1600	

Reversed and loaded with 50,000 pounds on the base for the purpose of straightening the rail.

Transverse test discontinued.

No. 30.

Branded "B T Co. Steel 76"



H Ex 161 52 1

No. 65.

Steel Rail No. 30.

Branded "B. I. Co. Steel, 76."
Height, 3″.95.
Width of base, 3″.97.
Weight per yard, 58.05 pounds.
Ends supported 30″ apart.
Loaded on base at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,560	0.	0.	0.	Initial load.
4,000	5,130	.0050	.0050	.....	
6,000	7,690	.0100	.0050	.....	
8,000	10,260	.0150	.0050	.....	
10,000	12,820	.0190	.0040	0.	
12,000	15,390	.0234	.0044	.....	
14,000	17,950	.0274	.0040	.....	
16,000	20,520	.0316	.0042	.....	
18,000	23,080	.0358	.0042	.....	
20,000	25,650	.0400	.0042	.0003	
Rail reversed in position and loaded on head at the middle.					
2,000	2,560	0.	0.	0.	Initial load.
4,000	5,130	.0055	.0055	.....	
6,000	7,690	.0103	.0048	.....	
8,000	10,260	.0149	.0046	.....	
10,000	12,820	.0194	.0045	.0008	
12,000	15,390	.0235	.0041	.....	
14,000	17,950	.0276	.0041	.....	
16,000	20,520	.0317	.0041	.....	
18,000	23,080	.0358	.0041	.....	
20,000	25,650	.0398	.0040	.0013	
22,000	28,210	.0440	.0042	.....	
24,000	30,780	.0478	.0038	.....	
26,000	33,340	.0517	.0039	.....	
28,000	35,910	.0555	.0038	.....	
30,000	38,470	.0595	.0040	.0015	E=22,880,000.
32,000	41,040	.0635	.0040	.....	
34,000	43,600	.0675	.0040	.....	
36,000	46,170	.0712	.0037	.....	
38,000	48,730	.0753	.0041	.....	
40,000	51,300	.0792	.0039	.0025	Elastic limit.
42,000	53,860	.0835	.0043	.....	
44,000	56,430	.0882	.0047	.....	
46,000	58,990	.0928	.0046	.....	
48,000	61,560	.0984	.0056	.....	
50,000	64,120	.1040	.0056	.0083	
52,000	66,690	.1140	.0100	.....	
54,000	69,250	.1360	.0220	.....	
56,000	71,820	.1630	.0270	.....	
58,000	74,380	.2026	.0396	.....	
60,000	76,950	.2502	.0476	.1333	
Load released and rail reversed in position, now loading the base at the middle as in first instance.					
2,000	2,560	0.	0.	0.	Initial load.
4,000	5,130	.0078	.0078	.....	
6,000	7,690	.0147	.0069	.....	
8,000	10,260	.0205	.0058	.....	
10,000	12,820	.0266	.0061	.0073	
12,000	15,390	.0318	.0052	.....	
14,000	17,950	.0379	.0061	.....	
16,000	20,520	.0438	.0059	.....	
18,000	23,080	.0498	.0060	.....	
20,000	25,650	.0564	.0066	.0172	
Load released and rail reversed, and now loaded on head at the middle.					

No. 65—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,560	0.	0.	0.	Initial load.
4,000	5,130	.0046	.0046	.....	
6,000	7,690	.0088	.0042	.....	
8,000	10,260	.0130	.0042	.....	
10,000	12,820	.0176	.0046	.0005	
12,000	15,390	.0217	.0041	.....	
14,000	17,950	.0257	.0040	.....	
16,000	20,520	.0298	.0041	.....	
18,000	23,080	.0339	.0041	.....	
20,000	25,650	.0381	.0042	.0010	
Load released, rail reversed, and loaded on base at the middle.					
2,000	2,560	0.	0.	0.	Initial load.
10,000	12,820	.0190	.0190	.0009	
20,000	25,650	.0405	.0215	.0020	
22,000	28,210	.0450	.0045	.....	
24,000	30,780	.0515	.0065	.....	
26,000	33,340	.0585	.0070	.....	
28,000	35,910	.0659	.0074	.....	
30,000	38,470	.0745	.0086	.0160	
32,000	41,040	.0830	.0085	.....	
34,000	43,600	.0915	.0085	.....	
36,000	46,170	.1000	.0085	.....	
38,000	48,730	.1095	.0095	.....	
40,000	51,300	.1210	.0115	.0423	
Load released, rail reversed in position, and load applied on head at middle.					
2,000	2,560	0.	0.	0.	Initial load.
4,000	5,130	.0043	.0043	.....	
6,000	7,690	.0088	.0045	.....	
8,000	10,260	.0133	.0045	.....	
10,000	12,820	.0177	.0044	.0010	
12,000	15,390	.0222	.0045	.....	
14,000	17,950	.0267	.0045	.....	
16,000	20,520	.0312	.0045	.....	
18,000	23,080	.0358	.0046	.....	
20,000	25,650	.0402	.0044	.0035	
Load released, rail returned to first position, and loaded on base at middle.					
2,000	2,560	0.	0.	0.	Initial load.
10,000	12,820	.0190	.0190	.0008	
20,000	25,650	.0405	.0215	.0013	
30,000	38,470	.0616	.0211	.0028	
40,000	51,300	.0856	.0240	.0067	
42,000	53,860	.0940	.0084	.....	
44,000	56,430	.1038	.0098	.....	
46,000	58,990	.1178	.0140	.....	
48,000	61,560	.1325	.0147	.....	
50,000	64,120	.1472	.0147	.0480	
52,000	66,690	.1634	.0162	.....	
54,000	69,250	.1828	.0194	.....	
56,000	71,820	.2010	.0182	.....	
58,000	74,380	.2350	.0340	.....	
60,000	76,950	.2742	.0392	.1542	
Load released, rail reversed, and loaded at the middle on the head.					
2,000	2,560	.0	.0	0.	Initial load.
4,000	5,130	.0050	.0050	.....	
6,000	7,690	.0099	.0049	.....	
8,000	10,260	.0155	.0056	.....	
10,000	12,820	.0205	.0050	.0037	
12,000	15,390	.0255	.0050	.....	
14,000	17,950	.0312	.0057	.....	
16,000	20,520	.0363	.0051	.....	
18,000	23,080	.0422	.0059	.....	
20,000	25,650	.0483	.0061	.0110	
Load released, rail reversed, and loaded on the base at the middle.					

No. 65—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,560	0.	0.	0.	Initial load.
10,000	12,820	.0186	.0186	.0009	
20,000	25,650	.0402	.0216	.0018	
30,000	38,470	.0618	.0216	.0028	
40,000	51,300	.0834	.0216	.0045	
50,000	64,120	.1070	.0236	.0075	
60,000	76,950	.1422	.0352	.0223	
62,000	79,510	.1718	.0296	.....	
64,000	82,080	.2200	.0482	.....	
66,000	84,640	.2870	.0670	.....	
68,000	87,210	.3605	.0735	.....	
70,000	89,770	.4393	.0788	.2967	
Load released, rail reversed in position, and loaded on head at the middle.					
2,000	2,560	0.	0.	0.	Initial load.
4,000	5,130	.0049	.0049	.....	
6,000	7,690	.0107	.0058	.....	
8,000	10,260	.0167	.0060	.....	
10,000	12,820	.0219	.0052	.0050	
12,000	15,390	.0280	.0061	.....	
14,000	17,950	.0340	.0060	.....	
16,000	20,520	.0408	.0068	.....	
18,000	23,080	.0476	.0068	.....	
20,000	25,650	.0540	.0064	.0165	
22,000	28,210	.0608	.0068	.....	
24,000	30,780	.0678	.0070	.....	
26,000	33,340	.0770	.0092	.....	
28,000	35,910	.0850	.0080	.....	
30,000	38,470	.0951	.0101	.0475	
32,000	41,040	.1047	.0096	.....	
34,000	43,600	.1135	.0088	.....	
36,000	46,170	.1235	.0100	.....	
38,000	48,730	.1385	.0150	.....	
40,000	51,300	.1478	.0093	.0705	
Load released, rail reversed, and loaded on the base at the middle.					
2,000	2,560	0.	0.	0.	Initial load.
10,000	12,820	.0195	.0195	.0017	
20,000	25,650	.0427	.0232	.0040	
30,000	38,470	.0665	.0238	.0076	
40,000	51,300	.0925	.0260	.0132	
50,000	64,120	.1231	.0306	.0225	
60,000	76,950	.1608	.0377	.0397	
70,000	89,770	.2350	.0742	.0918	Test discontinued.

No. 74.

RAIL NO. 30.

Height at middle, 3″.95.

Ends supported 22″.1 apart. Loaded on base at the middle

Ultimate strength, 95,700 pounds; R=90,410 pounds per square inch.

Fractured with permanent deflection hardly appreciable.

Appearance, granular, radiating from a point at the surface of the head.

The metal to a depth of from ″.01 to ″.03 under the tread of the wheel presented a sheared appearance.

No. 75.

RAIL NO. 30.

Height at middle, 3″.95.

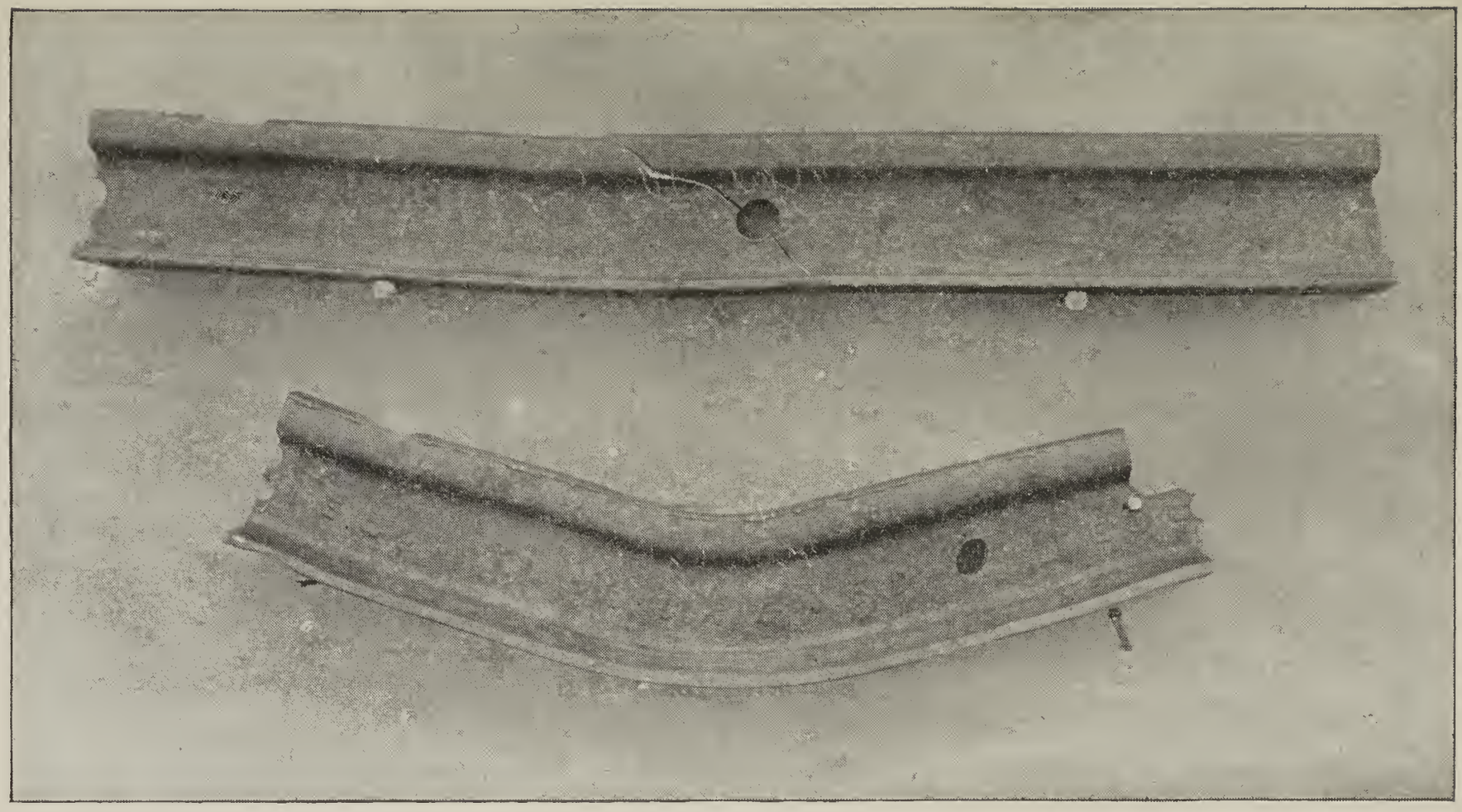
Ends supported 22″.1 apart. Loaded on the head at middle.

There was a fifteen-sixteenths inch drilled hole through the web, 4½ inches from middle of specimen.

At 100,000 pounds pressure a crack started at the hole in the web, extending obliquely three-eighths inch.

Ultimate strength, 103,900 pounds; R=98,160 pounds per square inch.

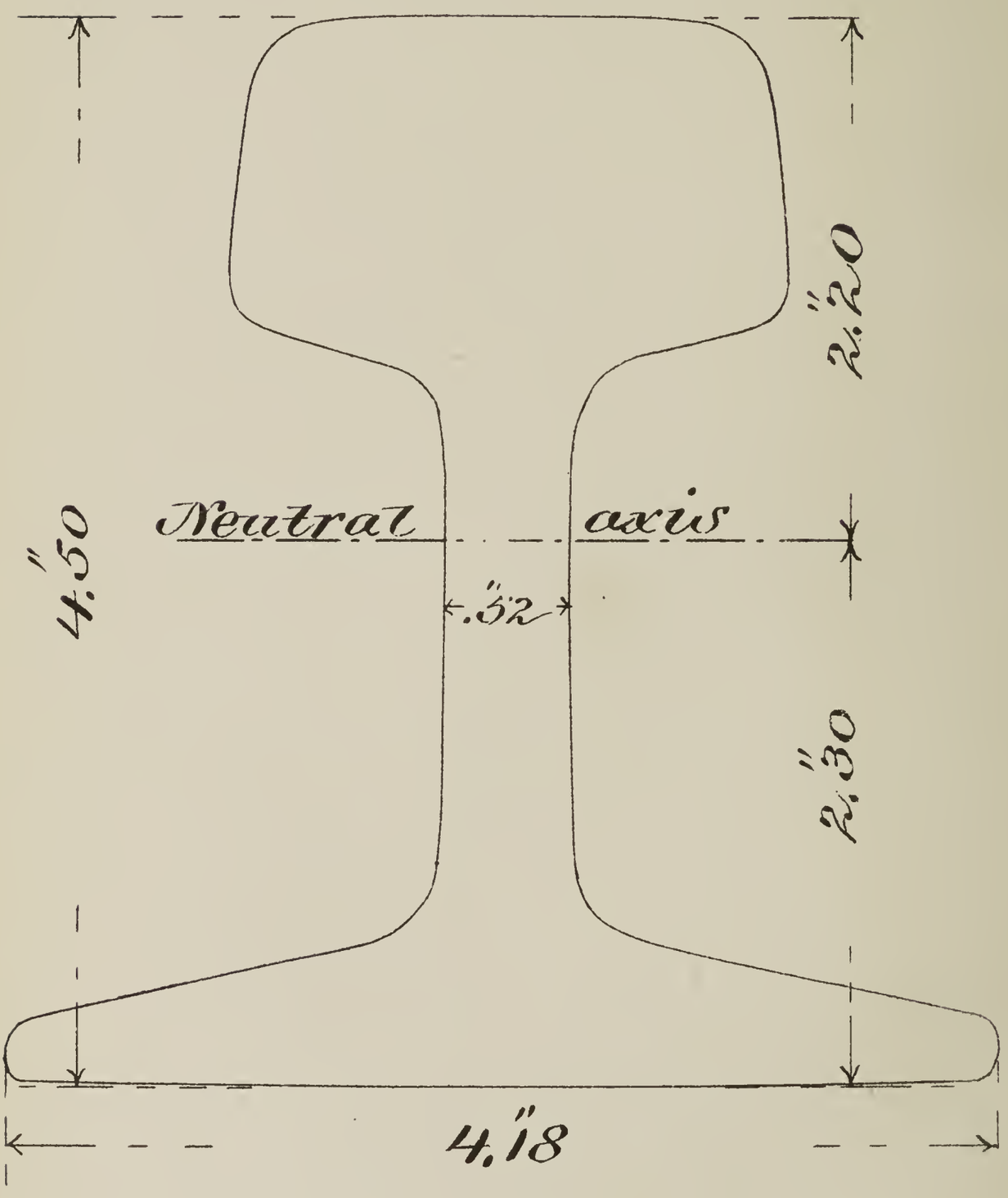
Fractured obliquely, extending the crack at the bolt hole in the web to the top surface of the head, and from the bolt hole obliquely through the base. Appearance, granular, radiating on each side from the bolt hole.



No. 30—No. 35.

No. 32.

Branded "A-B-S-89 III"



H Ex 161 52 1

No. 66.

STEEL RAIL No. 32.

Section of new rail, branded "A–B–S–89, 111."
Height, 4″.50.
Width of base, 4″.18.
Weight per yard, 65.02 pounds.
Ends supported 30″ apart.
Loaded on base at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,060	0.	0.	0.	Initial load.
6,000	6,180	.0076	.0076	.....	
10,000	10,300	.0143	.0067	.0002	
14,000	14,420	.0210	.0067	.....	
18,000	18,540	.0272	.0062	.....	
20,000	20,600	.0302	.0030	.0004	
24,000	24,720	.0363	.0061	.....	
28,000	28,840	.0425	.0062	.....	
30,000	30,900	.0454	.0029	.0005	
10,000	10,300	.....	.....	.....	Rested under load 15 hours.
30,000	30,900	.0447	.0007	.....	
32,000	32,960	.0477	.0030	.....	
34,000	35,020	.0507	.0030	.....	
36,000	37,090	.0536	.0029	.....	
38,000	39,150	.0564	.0028	.....	
40,000	41,210	.0592	.0028	.0002	
42,000	43,270	.0622	.0030	.....	
44,000	45,330	.0650	.0028	.....	
46,000	47,390	.0679	.0029	.....	
48,000	49,450	.0708	.0029	.....	
50,000	51,510	.0737	.0029	.0005	
Load released, rail reversed in position, and loaded on the head at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
6,000	6,180	.0067	.0067	.....	
10,000	10,300	.0131	.0064	0.	
14,000	14,420	.0196	.0065	.....	
18,000	18,540	.0257	.0061	.....	
20,000	20,600	.0285	.0028	—.0002	
24,000	24,720	.0345	.0060	.....	
28,000	28,840	.0405	.0060	.....	
30,000	30,900	.0435	.0030	0.	
34,000	35,020	.0492	.0057	.....	
38,000	39,150	.0550	.0058	.....	
40,000	41,210	.0577	.0027	0.	
44,000	45,330	.0638	.0061	.....	
48,000	49,450	.0696	.0058	.....	
50,000	51,510	.0726	.0030	.0008	E = 22,460,000.
52,000	53,570	.0760	.0034	.....	
54,000	55,630	.0790	.0030	.....	
56,000	57,690	.0821	.0031	.....	
58,000	59,750	.0854	.0033	.....	
60,000	61,810	.0887	.0033	.0028	Elastic limit.
62,000	63,870	.0925	.0038	.....	
64,000	65,930	.0962	.0037	.....	
66,000	67,990	.1000	.0038	.....	
68,000	70,050	.1037	.0037	.....	
70,000	72,110	.1085	.0048	.0085	
72,000	74,170	.1135	.0050	.....	
74,000	76,230	.1181	.0046	.....	
76,000	78,290	.1238	.0057	.....	
78,000	80,350	.1298	.0060	.....	
80,000	82,410	.1397	.0099	.0247	
82,000	84,470	.1520	.0123	.....	
84,000	86,530	.1732	.0212	.....	
86,000	88,590	.1913	.0181	.....	
88,000	90,650	.2145	.0232	.....	
90,000	92,710	.2395	.0250	.1068	
Rail reversed in position and loaded on base at the middle.					

No. 66—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,060	0.	0.	0.	Initial load.
4,000	4,120	.0047	.0047	----------	
6,000	6,180	.0094	.0047	----------	
8,000	8,240	.0135	.0041	----------	
10,000	10,300	.0179	.0044	.0045	
12,000	12,360	.0223	.0044	----------	
14,000	14,420	.0263	.0040	----------	
16,000	16,480	.0311	.0048	----------	
18,000	18,540	.0356	.0045	----------	
20,000	20,600	.0404	.0048	.0111	
		Rail reversed in position and loaded on head at the middle.			
2,000	2,060	0.	.0	0.	Initial load.
4,000	4,120	.0033	.0033	----------	
6,000	6,180	.0067	.0034	----------	
8,000	8,240	.0101	.0034	----------	
10,000	10,300	.0134	.0033	.0003	
12,000	12,360	.0168	.0034	----------	
14,000	14,420	.0200	.0032	----------	
16,000	16,480	.0235	.0035	----------	
18,000	18,540	.0266	.0031	----------	
20,000	20,600	.0298	.0032	.0008	
		Rail reversed in position and loaded on base at the middle.			
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0141	.0141	.0005	
20,000	20,600	.0312	.0171	.0017	
22,000	22,660	.0349	.0037	----------	
24,000	24,720	.0393	.0044	----------	
26,000	26,780	.0442	.0049	----------	
28,000	28,840	.0493	.0051	----------	
30,000	30,900	.0543	.0050	.0100	
32,000	32,960	.0595	.0052	----------	
34,000	35,020	.0644	.0049	----------	
36,000	37,090	.0692	.0048	----------	
38,000	39,150	.0749	.0057	----------	
40,000	41,210	.0803	.0054	.0215	
		Reversed in position and loaded on head at the middle.			
2,000	2,060	0.	0.	0.	Initial load.
4,000	4,120	.0036	.0036	----------	
6,000	6,180	.0072	.0036	----------	
8,000	8,240	.0106	.0034	----------	
10,000	10,300	.0140	.0034	.0009	
12,000	12,360	.0172	.0032	----------	
14,000	14,420	.0206	.0034	----------	
16,000	16,480	.0239	.0033	----------	
18,000	18,540	.0272	.0033	----------	
20,000	20,600	.0305	.0033	.0017	
		Reversed in position and loaded on base at the middle.			
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0136	.0136	.0002	
20,000	20,600	.0298	.0162	.0005	
30,000	30,960	.0453	.0155	.0012	
40,000	41,210	.0619	.0166	.0032	
42,000	43,270	.0668	.0049	----------	
44,000	45,330	.0713	.0045	----------	
46,000	47,390	.0774	.0061	----------	
48,000	49,450	.0835	.0061	----------	
50,000	51,510	.0899	.0064	.0167	
52,000	53,570	.0969	.0070	----------	
54,000	55,630	.1032	.0063	----------	
56,000	57,990	.1092	.0060	----------	
58,000	59,750	.1160	.0068	----------	
60,000	61,710	.1235	.0075	.0355	
		Reversed in position and loaded on head at the middle.			

No. 66—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,060	0.	0.	0.	Initial load.
4,000	4,120	.0037	.0037	.....	
6,000	6,180	.0072	.0035	.....	
8,000	8,240	.0107	.0035	.....	
10,000	10,300	.0142	.0035	.0012	
12,000	12,360	.0177	.0035	.....	
14,000	14,420	.0210	.0033	.....	
16,000	16,480	.0245	.0035	.....	
18,000	18,540	.0280	.0035	.....	
20,000	20,600	.0317	.0037	.0027	
Reversed in position and loaded on the base at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.1037	.1037	.0003	
20,000	20,600	.0296	.0159	.0007	
30,000	30,900	.0451	.0155	.0013	
40,000	41,210	.0603	.0152	.0015	
50,000	51,510	.0760	.0157	.0025	
60,000	61,810	.0951	.0191	.0073	
62,000	63,870	.1018	.0067	.....	
64,000	65,930	.1072	.0054	.....	
66,000	67,990	.1147	.0075	.....	
68,000	70,050	.1226	.0079	.....	
70,000	72,110	.1325	.0099	.0294	
72,000	74.170	.1429	.0104	.....	
74,000	76,230	.1493	.0064	.....	
76,000	78,290	.1595	.0102	.....	
78,000	80,350	.1697	.0102	.....	
80,000	82,410	.1824	.0127	.0633	
Reversed in position and loaded on the head at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
4,000	4,120	.0037	.0037	.....	
6,000	6,180	.0073	.0036	.....	
8,000	8,240	.0110	.0037	.....	
10,000	10,300	.0147	.0037	.0020	
12,000	12,360	.0187	.0040	.....	
14,000	14,420	.0227	.0040	.....	
16,000	16,480	.0265	.0038	.....	
18,000	18,540	.0302	.0037	.....	
20,000	20,600	.0340	.0038	.0056	
Reversed in position and loaded on the base at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0134	.0134	.0002	
20,000	20,600	.0292	.0158	.0004	
30,000	30,900	.0447	.0155	.0007	
40,000	41,210	.0597	.0150	.0010	
50,000	51,510	.0751	.0154	.0018	
60,000	61,810	.0908	.0157	.0025	
70,000	72,110	.1072	.0164	.0044	
80,000	82.410	.1294	.0222	.0108	
82,000	84,470	.1375	.0081	.....	
84,000	86,530	.1469	.0094	.....	
86,000	88,590	.1600	.0131	.....	
88,000	90,650	.1799	.0199	.....	
90,000	92,710	.1902	.0103	.0558	
Reversed in position and loaded on the head at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
4,000	4,120	.0037	.0037	.....	
6,000	6,180	.0078	.0041	.....	
8,000	8,240	.0119	.0041	.....	
10,000	10,300	.0159	.0040	.0028	
12,000	12,360	.0200	.0041	.....	
14,000	14,420	.0240	.0040	.....	
16,000	16,480	.0282	.0042	.....	
18,000	18,540	.0325	.0043	.....	
20,000	20,600	.0365	.0040	.0080	
Reversed in position and loaded on the base at the middle.					

No. 66—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0135	.0135	.0002	
20,000	20,600	.0297	.0162	.0010	
30,000	30,900	.0456	.0159	.0014	
40,000	41,210	.0610	.0154	.0022	
50,000	51,510	.0765	.0155	.0025	
60,000	61,810	.0920	.0155	.0035	
70,000	72,110	.1080	.0160	.0048	
80,000	82,410	.1262	.0182	.0078	
10,000	10,300	.....	.....	.....	Rested under load 15 hours.
90,000	92,710	.1492	.0230	.....	
92,000	94,780	.1665	.0173	.....	
94,000	96,840	.1932	.0267	.....	
96,000	98,900	.2180	.0248	.....	
98,000	100,960	.2470	.0290	.....	
100,000	103,020	.2769	.0299	.1223	
10,000	10,300	.1350	—.1419	.1222	
20,000	20,600	.1508	+.0158	.1220	
30,000	30,900	.1660	.0152	.1218	
40,000	41,210	.1808	.0148	.1218	
50,000	51,510	.1958	.0150	.1217	
60,000	61,810	.2110	.0152	.1218	
		Reversed in position and loaded on the head at the middle.			
2,000	2,060	0.	0.	0.	Initial load.
4,000	4,120	.0045	.0045	.....	
6,000	6,180	.0087	.0042	.....	
8,000	8,240	.0132	.0045	.....	
10,000	10,300	.0177	.0045	.0047	
12,000	12,360	.0220	.0043	.....	
14,000	14,420	.0267	.0047	.....	
16,000	16,480	.0317	.0050	.....	
18,000	18,540	.0362	.0045	.....	
20,000	20,600	.0417	.0055	.0131	
10,000	10,300	.0263	—.0154	.0131	
18,000	18,540	.0388	+.0125	.0131	
20,000	20,600	.0423	.0035	.....	
22,000	22,660	.0457	.0034	.....	
24,000	24,720	.0510	.0053	.....	
26,000	26,780	.0563	.0053	.....	
28,000	28,840	.0617	.0054	.....	
30,000	30,900	.0674	.0057	.0232	
32,000	32,960	.0736	.0062	.....	
34,000	35,020	.0792	.0056	.....	
36,000	37,090	.0852	.0060	.....	
38,000	39,150	.0915	.0063	.....	
40,000	41,210	.0980	.0065	.0388	
38,000	39,150	.0962	—.0018	.0397	
36,000	37,090	.0935	—.0027	.0398	
40,000	41,210	.1003	+.0068	.....	
42,000	43,270	.1062	.0059	.....	
44,000	45,330	.1116	.0054	.....	
46,000	47,390	.1187	.0071	.....	
48,000	49,450	.1267	.0080	.....	
50,000	51,510	.1342	.0075	.....	
		.1367	.0025	.0626	After 5 minutes.
48,000	49,450	.1348	—.0019	.0635	
46,000	47,390	.1320	—.0028	.0633	
52,000	53,570	.1433	+.0113	.....	
54,000	55,630	.1508	.0075	.....	
56,000	57,690	.1586	.0078	.....	
58,000	59,750	.1698	.0112	.....	
60,000	61,810	.1762	.0064	.....	Immediate deflection.
		.1820	.0058	.0925	After 5 minutes.
		Reversed in position and loaded on the base at the middle.			
2,000	2,060	0.	0.	0.	Initial load.
4,000	4,120	.0039	.0039	.....	
6,000	6,180	.0074	.0035	.....	
8,000	8,240	.0109	.0035	.....	
10,000	10,300	.0144	.0035	.0011	
12,050	12,360	.0177	.0033	.....	
14,000	14,420	.0213	.0036	.....	
16,000	16,480	.0249	.0036	.....	
18,000	18,540	.0282	.0033	.....	

No. 66—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
20,000	20,600	.0318	.0036	.0027	
22,000	22,660	.0352	.0034	.....	
24,000	24,720	.0387	.0035	.....	
26,000	26,780	.0422	.0035	.....	
28,000	28,840	.0457	.0035	.....	
30,000	30,900	.0493	.0036	.0050	
32,000	32,960	.0530	.0037	.....	
34,000	35,020	.0562	.0032	.....	
36,000	37,090	.0597	.0035	.....	
38,000	39,150	.0633	.0036	.....	
40,000	41,210	.0671	.0038	.0081	
42,000	43,270	.0708	.0037	.....	
44,000	45,330	.0743	.0035	.....	
46,000	47,390	.0783	.0040	.....	
48,000	49,450	.0821	.0038	.....	
50,000	51,510	.0862	.0041	.0125	
52,000	53,570	.0906	.0044	.....	
54,000	55,630	.0946	.0040	.....	
56,000	57,690	.0986	.0040	.....	
58,000	59,750	.1026	.0040	.....	
60,000	61,810	.1071	.0045	.0186	
62,000	63,870	.1126	.0055	.....	
64,000	65,930	.1168	.0042	.....	
66,006	67,990	.1215	.0047	.....	
68,000	70,050	.1265	.0050	.....	
70,000	72,110	.1318	.0053	.0284	
72,000	74,170	.1384	.0066	.....	
74,000	76,230	.1434	.0050	.....	
76,000	78,290	.1488	.0054	.....	
78,000	80,350	.1545	.0057	.....	
80,000	82,410	.1617	.0072	.0428	
82,000	84,470	.1692	.0075	.....	
84,000	86,530	.1756	.0064	.....	
86,000	88,590	.1828	.0072	.....	
88,000	90,650	.1895	.0067	.....	
90,000	92,710	.1987	.0092	.0641	
92,000	94,780	.2111	.0124	.....	
94,000	96,840	.2188	.0077	.....	
96,000	98,890	.2297	.0109	.....	
98,000	100,960	.2435	.0138	.....	
100,000	103,020	.2632	.0197	.1107	
80,000	82,410	.2302	—.0330	.1112	
80,000	82,410	.2299	—.0003	.1112	
90,000	92,710	.2459	+.0160	.1117	
90,000	92,710	.2464	.0005	.1121	
		.2675	.0211	.....	Immediate deflection.
100,000	103,020	.2725	.0005	.....	After 5 minutes.
		.2760	.0035	.1245	After 65 minutes.
Reversed in position and loaded on the head at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0177	.0177	.0046	
20,000	20,600	.0420	.0243	.0123	
30,000	30,900	.0676	.0256	.0230	
40,000	41,210	.0987	.0311	.0390	
50,000	51,510	.1350	.0363	.0600	
60,000	61,810	.1808	.0458	.0905	
70,000	72,110	.2380	.0572	.1327	
80,000	82,410	.2900	.0520	.1695	
90,000	92,710	.3799	.0899	.2430	
100,000	103,020	.4975	.1176	.3422	
Reversed in position and loaded on the base at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0171	.0171	.0042	
20,000	20,600	.0402	.0231	.0113	
30,000	30,900	.0645	.0243	.0202	
40,000	41,210	.0930	.0285	.0335	
50,000	51,510	.1267	.0337	.0518	
60,000	61,810	.1677	.0410	.0776	
70,000	72,110	.2188	.0511	.1135	
80,000	82,410	.2815	.0627	.1605	
90,000	92,710	.3608	.0793	.2241	
100,000	103,020	.4645	.1037	.3105	
Reversed in position and loaded on the head at the middle.					

No. 66—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0163	.0163	.0035	
20,000	20,600	.0385	.0222	.0098	
30,000	30,900	.0634	.0249	.0190	
40,000	41,210	.0905	.0271	.0311	
50,000	51,510	.1235	.0330	.0488	
60,000	61,810	.1628	.0393	.0727	
70,000	72,110	.2138	.0510	.1088	
80,000	82,410	.2752	.0614	.1545	
90,000	92,710	.3545	.0793	.2177	
100,000	103,020	.4595	.1050	.3055	
Reversed in position and loaded on the base at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0169	.0169	.0037	
20,000	20,600	.0392	.0223	.0103	
30,000	30,900	.0633	.0241	.0188	
40,000	41,210	.0905	.0272	.0304	
50,000	51,510	.1232	.0327	.0480	
60,000	61,810	.1619	.0387	.0715	
70,000	72,110	.2102	.0483	.1046	
80,000	82,410	.2687	.0585	.1484	
90,000	92,710	.3482	.0795	.2113	
100,000	103,020	.4452	.0970	.2914	
Load of 100,000 pounds applied twenty times, ten times each to head and base. The load was sustained one-half minute each time applied. Reversed in position and loaded on the head at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0171	.0171	.0037	
20,000	20,600	.0391	.0220	.0093	
30,000	30,900	.0632	.0241	.0182	
40,000	41,210	.0900	.0268	.0295	
50,000	51,510	.1208	.0308	.0450	
60,000	61,810	.1586	.0378	.0675	
70,000	72,110	.2050	.0464	.0990	
80,000	82,410	.2590	.0540	.1372	
90,000	92,710	.3407	.0817	.2024	
100,000	103,020	.4410	.1003	.2865	
Reversed in position and loaded on the base at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0163	.0163	.0033	
20,000	20,600	.0385	.0223	.0091	
30,000	30,900	.0625	.0240	.0168	
40,000	41,210	.0810	.0185	.0213	
50,000	51,510	.1141	.0331	.0390	
60,000	61,810	.1536	.0395	.0626	
70,000	72,110	.2020	.0484	.0965	
80,000	82,410	.2603	.0583	.1383	
90,000	92,710	.3370	.0767	.1988	
100,000	103,020	.4379	.1009	.2818	
Rail rested 3 months 27 days, then test resumed, loading on the head at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0132	.0132	.0002	
20,000	20,600	.0291	.0159	.0003	
30,000	30,900	.0450	.0159	.0007	
40,000	41,210	.0620	.0170	.0023	
50,000	51,510	.0812	.0192	.0066	
60,000	61,810	.1047	.0235	.0150	
70,000	72,110	.1370	.0323	.0328	
80,000	82,410	.1660	.0290	.0455	
90,000	92,710	.2378	.0718	.1010	
100,000	103,020	.3426	.1048	.1874	
Rail reversed and loaded on the base at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0155	.0155	.0023	
20,000	20,600	.0358	.0203	.0072	
30,000	30,900	.0585	.0227	.0139	
40,000	41,210	.0832	.0247	.0225	
50,000	51,510	.1113	.0281	.0343	
----------	----------	----------	----------	----------	Micrometer disturbed.
100,000	103.020	----------	----------	----------	
Rail reversed and loaded on the head at the middle.					

No. 66—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0162	.0162	.0027	
20,000	20,600	.0367	.0205	.0078	
30,000	30,900	.0592	.0225	.0140	
40,000	41,210	.0840	.0248	.0229	
50,000	51,510	.1123	.0283	.0353	
60,000	61,810	.1448	.0325	.0519	
70,000	72,110	.1837	.0389	.0755	
80,000	82,410	.2300	.0463	.1066	
90,000	92,710	.2898	.0598	.1504	
100,000	103,020	.3770	.0872	.2206	
Loaded with 100,000 pounds ten times each on base and head, reversing the rail between each loading. The last load was applied to the head. Rail reversed and loaded on the base at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0163	.0163	.0032	
20,000	20,600	.0377	.0214	.0090	
30,000	30,900	.0616	.0239	.0179	
40,000	41,210	.0888	.0272	.0277	
50,000	51,510	.1197	.0309	.0427	
60,000	61,810	.1563	.0366	.0646	
70,000	72,110	.2038	.0475	.0958	
80,000	82,410	.2625	.0587	.1375	
90,000	92,710	.3340	.0715	.1940	
100,000	103,020	.4258	.0918	.2695	
Rail reversed and loaded on the head at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0172	.0172	.0043	
20,000	20,600	.0390	.0218	.0095	
30,000	30,900	.0575	.0185	.0177	
40,000	41,210	.0896	.0321	.0285	
50,000	51,510	.1208	.0312	.0436	
60,000	61,810	.1580	.0372	.0648	
70,000	72,110	.2033	.0453	.0949	
80,000	82,410	.2602	.0569	.1360	
90,000	92,710	.3309	.0707	.1947	
100,000	103,020	.4187	.0878	.2620	
Loaded with 100,000 pounds ten times each on base and head, reversing the rail between each loading. The last load was applied to the head. The rail was perceptibly warmed by the repeated loading. Rail now reversed and loaded on the base at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0166	.0166	.0039	
20,000	20,600	.0380	.0214	.0093	
30,000	30,900	.0618	.0238	.0175	
40,000	41,210	.0890	.0272	.0283	
50,000	51,510	.1217	.0327	.0450	Rested under 10,000 pounds 14 hours.
60,000	61,810	.1458	.0241	.0553	
70,000	72,110	.1965	.0507	.0890	
80,000	82,410	.2572	.0607	.1338	
90,000	92,710	.3316	.0744	.1922	
100,000	103,020	.4255	.0939	.2695	
Rail reversed and loaded on the head at the middle.					
2,000	2,060	0.	0.	0.	Initial load.
10,000	10,300	.0160	.0160	.0035	
20,000	20,600	.0372	.0212	.0087	
30,000	30,900	.0615	.0243	.0171	
40,000	41,210	.0873	.0258	.0270	
50,000	51,510	.1193	.0320	.0427	
60,000	61,810	.1555	.0362	.0631	
70,000	72,110	.2081	.0526	.0921	
80,000	82,410	.2575	.0494	.1335	
90,000	92,710	.3288	.0713	.1887	
100,000	103,020	.4230	.0942	.2662	

Rail reversed and loaded with 80,000 pounds on the base at the middle for the purpose of straightening the head.

Transverse test discontinued and tensile specimen taken from the head.

No. 67.

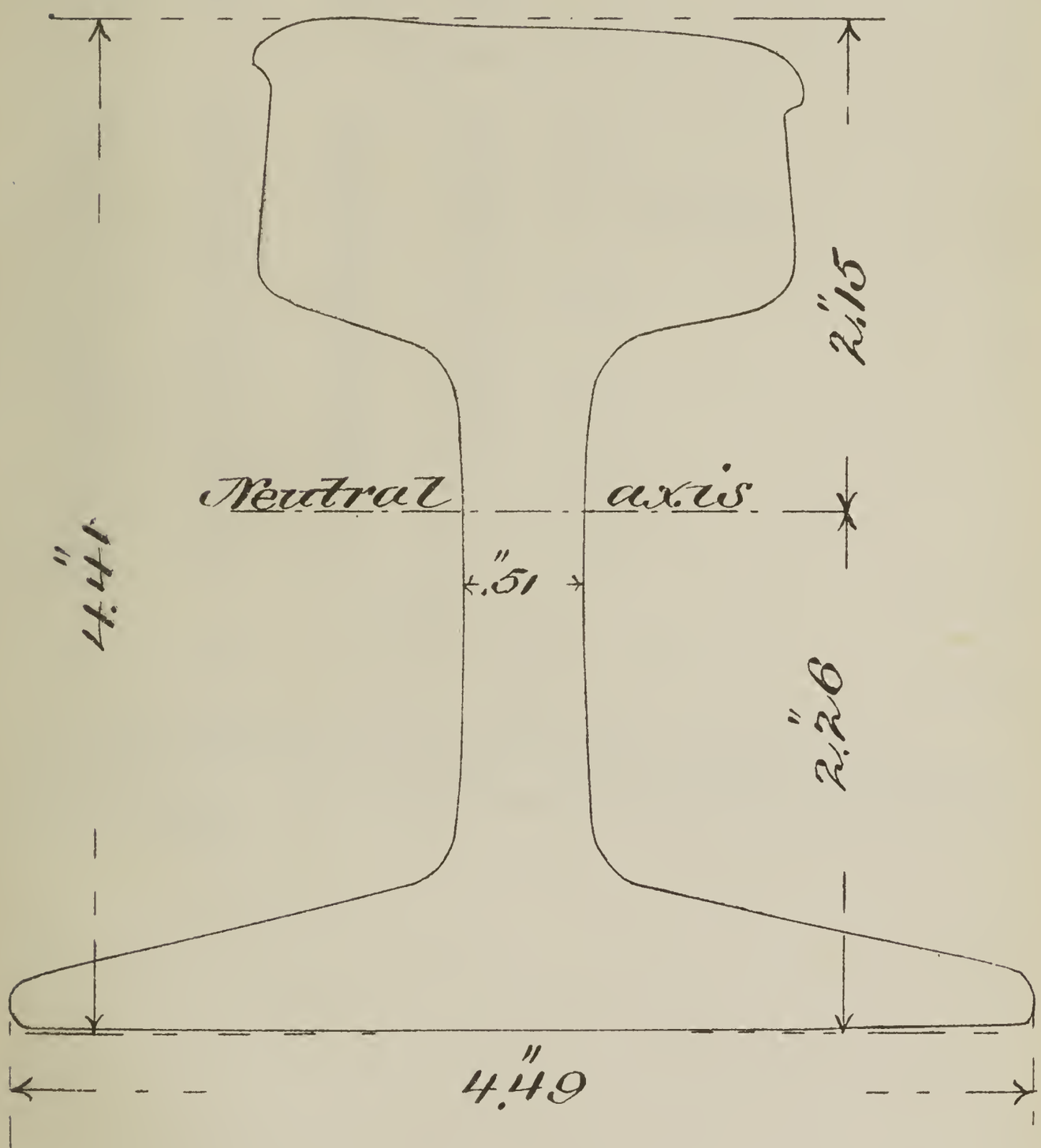
Steel Rail No. 34.

Branded "W. I. Co. Steel, 82."
Height, 4″.41; width of base, 4″.49; weight per yard, 64.66 pounds.
Supported at ends 54″ apart.
Loaded on head at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	3,700	0.	0.	.0	Initial load.
4,000	7,400	.0157	.0157	.....	
6,000	11,100	.0315	.0158	.....	
8,000	14,800	.0477	.0162	.....	
10,000	18,500	.0635	.0158	.0007	
4,000	7,400	.0163	—.0472	.....	
6,000	11,100	.0321	+.0158	.....	
8,000	14.800	.0481	.0160	.....	
10,000	18,500	.0636	.0155	.0009	
		Reversed and loaded on base.			
2,000	3,700	0.	0.	0.	Initial load.
4,000	7,400	.0166	.0166	.....	
6,000	11,100	.0327	.0161	.....	
8,000	14,800	.0488	.0161	.....	
10,000	18,500	.0650	.0162	.0015	
4,000	7,400	.0177	—.0473	.....	
6,000	11,100	.0335	+.0158	.....	
8.000	14,800	.0493	.0158	.....	
10,000	18,500	.0653	.0160	.0012	
		Distance between end supports reduced to 42″. Loaded on the head.			
2,000	2,880	0.	0.	0.	Initial load.
4,000	5,750	.0085	.0085	.....	
6,000	8,630	.0167	.0082	.....	
8,000	11,510	.0243	.0076	.....	
10,000	14,390	.0322	.0079	.0008	
10,000	14,390	.0331	.0009	.0015	
4,000	5,750	.0096	—.0235	.....	
6,000	8,630	.0175	+.0079	.....	
8,000	11,510	.0250	.0075	.....	
10,000	14,390	.0331	.0081	.0015	
		Reversed and loaded on base.			
2,000	2,880	0.	0.	0.	Initial load.
4,000	5,750	.0090	.0090	.....	
6,000	8,630	.0173	.0083	.....	
8,000	11,510	.0255	.0082	.....	
10,000	14,390	.0335	.0080	.0020	
4,000	5,750	.0102	—.0233	.....	
6,000	8,630	.0177	+.0075	.....	
8,000	11,510	.0258	.0081	.....	
10,000	14,390	.0336	.0078	.0020	
		Distance between end supports reduced to 30″. Loaded on the head.			
2,000	2,050	0.	0.	0.	Initial load.
4,000	4,110	.0037	.0037	.....	
6,000	6,160	.0070	.0033	.....	
8,000	8,220	.0102	.0032	.....	
10,000	10,270	.0135	.0033	.0004	
12,000	12,330	.0168	.0033	.....	
14,000	14,380	.0200	.0032	.....	
16,000	16,440	.0232	.0032	.....	
18,000	18,490	.0265	.0033	.....	
20,000	20,550	.0295	.0030	.0006	
		Reversed and loaded on base.			

No. 34.

Branded "W I Co. Steel 82".



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No. 67—Continued.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inches.*	*Inch.*	*Inch.*	
2,000	2,050	0.	0.	0.	Initial load.
4,000	4,110	.0040	.0040	----------	
6,000	6,160	.0075	.0035	----------	
8,000	8,220	.0105	.0030	----------	
10,000	10,270	.0136	.0031	.0002	
12,000	12,330	.0168	.0032	----------	
14,000	14,380	.0200	.0032	----------	
16,000	16,440	.0234	.0034	----------	
18,000	18,490	.0267	.0033	----------	
20,000	20,550	.0299	.0032	.0006	
		Reversed and loaded on head.			
2,000	2,050	0.	0.	0.	Initial load.
10,000	10,270	.0133	.0133	.0000	
20,000	20,550	.0297	.0164	.0007	
22,000	22,600	.0330	.0033	----------	
30,000	30,820	.0453	.0123	.0005	
40,000	41,100	.0618	.0165	.0017	E=21,560,000.
42,000	43,150	.0650	.0032	----------	Elastic limit.
44,000	45,210	.0685	.0035	----------	
46,000	47,260	.0722	.0037	----------	
48,000	49,320	.0762	.0040	----------	
50,000	51,380	.0805	.0043	.0048	
52,000	53,430	.0850	.0045	----------	
54,000	55,480	.0911	.0061	----------	
56,000	57,540	.1006	.0095	----------	
58,000	59,590	.1180	.0174	----------	
60,000	61,650	.1790	.0610	.0864	
62,000	63,700	.2435	.0645	----------	
64,000	65,760	.2946	.0511	----------	
66,000	67,810	.3557	.0611	----------	
68,000	69,870	.4245	.0688	----------	
70,000	71,920	.4930	.0685	.3795	
72,000	73,980	.58	.0870	----------	
74,000	76,030	.67	.09	----------	
76,000	78,090	.78	.11	----------	
78,000	80,140	.90	.12	----------	
80,000	82,200	1.08	.18	----------	
		Reversed and loaded on base.			
76,000	78,090	----------	----------	----------	Rail fractured.

Granular appearance, radiating from lower side of the head.

The metal from the surface of the head to a depth of about ″.05 presented a smooth surface at the fracture, having the appearance of a sheared fracture.

No. 68.

Test of another piece of Rail No. 34.

Ends supported 54″ apart.
Loaded at the middle on the base.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	3,700	0.	0.	0.	Initial load.
4,000	7,400	.0188	.0188	.....	
6,000	11,100	.0370	.0182	.....	
8,000	14,800	.0550	.0180	.....	
10,000	18,500	.0722	.0172	.0020	
12,000	22,200	.0895	.0173	.....	
14,000	25,890	.1062	.0167	.....	
16,000	29,590	.1225	.0163	.....	
18,000	33,290	.1392	.0167	.....	
20,000	36,990	.1563	.0171	.0067	
22,000	40,690	.1743	.0180	.....	
24,000	44,390	.1975	.0232	.....	
26,000	48,090	.2320	.0345	.....	
28,000	51,790	.2867	.0547	.....	
30,000	55,490	.3820	.0953	.1578	
32,000	59,190	.56	.178	.....	
33,400	61,770	.....	.....	.....	Ultimate strength.

Granular fracture; the metal at the worn surface of the head, for a depth of about ″.05, had a smooth, sheared appearance.

No. 92.

Rail No. 34.

Top surface of head planed off, and corners rounded with $\frac{3}{16}$″ radius.
Height, 4″.20.
Width of base, 4″.50.
Ends supported 30″ apart.
Loaded on base at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inches.*	*Inch.*	*Inch.*	
2,000	2,220	0.	0.	0.	Initial load.
4,000	4,440	.0042	.0042	.....	
6,000	6,660	.0082	.0040	.....	
8,000	8,880	.0120	.0038	.....	
10,000	11,000	.0157	.0037	.0005	
12,000	13,330	.0193	.0036	.....	
14,000	15,550	.0230	.0037	.....	
16,000	17,770	.0265	.0035	.....	
18,000	19,990	.0302	.0037	.....	
20,000	22,210	.0337	.0035	.0009	
22,000	24,430	.0377	.0040	.....	
24,000	26,650	.0414	.0037	.....	
26,000	28,880	.0450	.0036	.....	
28,000	31,100	.0488	.0038	.....	
30,000	33,320	.0528	.0040	.0026	E=21,710,000.
32,000	35,540	.0568	.0040	.....	
34,000	37,760	.0610	.0042	.....	Elastic limit.
36,000	39,980	.0655	.0045	.....	
38,000	42,200	.0703	.0048	.....	
40,000	44,430	.0767	.0064	.0092	Scale starts from base.
42,000	46,650	.0850	.0083	.....	
44,000	48,870	.0936	.0086	.....	
46,000	51,090	.1115	.0179	.....	
48,000	53,310	.1413	.0298	.0598	
50,000	55,530	.17	.0287	.....	
52,000	57,750	.26	.09	.....	
54,000	59,970	.29	.03	.....	
56,000	62,200	.35	.06	.....	
58,000	64,420	.44	.09	.....	
60,000	66,640	.51	.07	.....	
62,000	68,860	.61	.10	.....	
64,000	71,080	.71	.10	.....	
66,000	73,300	.82	.11	.....	
68,000	75,520	.94	.12	.....	
70,000	77,740	1.08	.14	.....	
72,000	79,970	1.29	.21	.....	
74,000	82,190	1.49	.20	.....	
76,000	84,410	1.80	.31	.....	
78,000	86,630	2.17	.37	.....	
80,000	88,850	2.64	.47	.....	
89,500	99,400	.....	.....	.....	Ultimate strength.

Deflections continued bending the rail through 37° without fracture.

No. 93.

Rail No. 34.

Longer end of specimen No. 92.
Ends supported 17″.1 apart.
Loaded on head at the middle; 168,000 pounds applied, which bent the rail through 50 degrees without fracture. R = 106,350 pounds per square inch.

No. 69.

Piece of Rail No. 34.

Distance between end bearings, 30 inches.
Loaded on the base at the middle.
Height of rail at middle bearing, 4″.41.
Ultimate strength, 63,900 pounds; R = 65,660 pounds per square inch.
Granular fracture, sheared appearance ″.05 deep at surface of head.
Sharp snapping sounds were heard when load reached 61,000 pounds.
Permanent deflection before rupture, inappreciable.

No. 70.

Piece of Rail No. 34.

Distance between end supports, 30 inches.
Loaded on the head at the middle.
Height of rail at middle bearing, 4″.41.
Ultimate strength, 99,800 pounds; R = 102,550 pounds per square inch.
Deflections continued after passing the maximum load until the rail was bent an angle of 40 degrees.
Rail not fractured.

No. 71.

Piece of Rail No. 34, about 20 Inches Long.

There were granular fractures at each end of this piece where fracture had been caused by bending, the head being on the tension side of the bend.

The end fractures occurred without appreciable permanent deflection preceding rupture.

In the present tests the loads were applied on the head, with the end bearings 17″ apart.

Ultimate strength, 162,000 pounds; R = 94,330 pounds per square inch.

After passing the maximum stress loads were continued, increasing the deflection of the rail. When the rail had been bent through an angle of about 25 degrees, a crack was started at the edge of the outer flange of the base, at a place where a spike in the tie had worn a notch in the flange.

The metal had been worn away until this notch caused by the abrasive action of the spike was ″.10 deep. This place came at the middle of the span between the end bearings.

The crack in the flange gradually extended to a depth of $\frac{3}{4}$″ as the deflection of the rail increased, presenting an oblique sheared surface in appearance.

When the rail had reached the maximum deflection, and had been bent through an angle of 30 degrees, the balance of the rail parted with a granular fracture, radiating from the notched flange.

At the worn surface of the top of the head the metal from ″.02 to ″.05 deep had a serrated sheared appearance, with inclined lines between layers of metal which had flowed in an outward direction under the wheel pressures.

No. 72.

Rail No. 34.

One end from test No. 67.

Head planed off, reducing height to 4″.25, for the purpose of removing the metal immediately affected by the cold flow caused by the wheel pressures when in service.

Supported at ends 30″ apart.

Loaded at the middle on the base.

Ultimate strength, 54,900 pounds.

Appearance, granular; the corners *a a* showed metal which had flowed under the wheel pressures.

No. 72*a*.

One end of fractured section No. 72.

Corners at *a a* rounded in the planer and tested with end bearings 17″.1 apart.

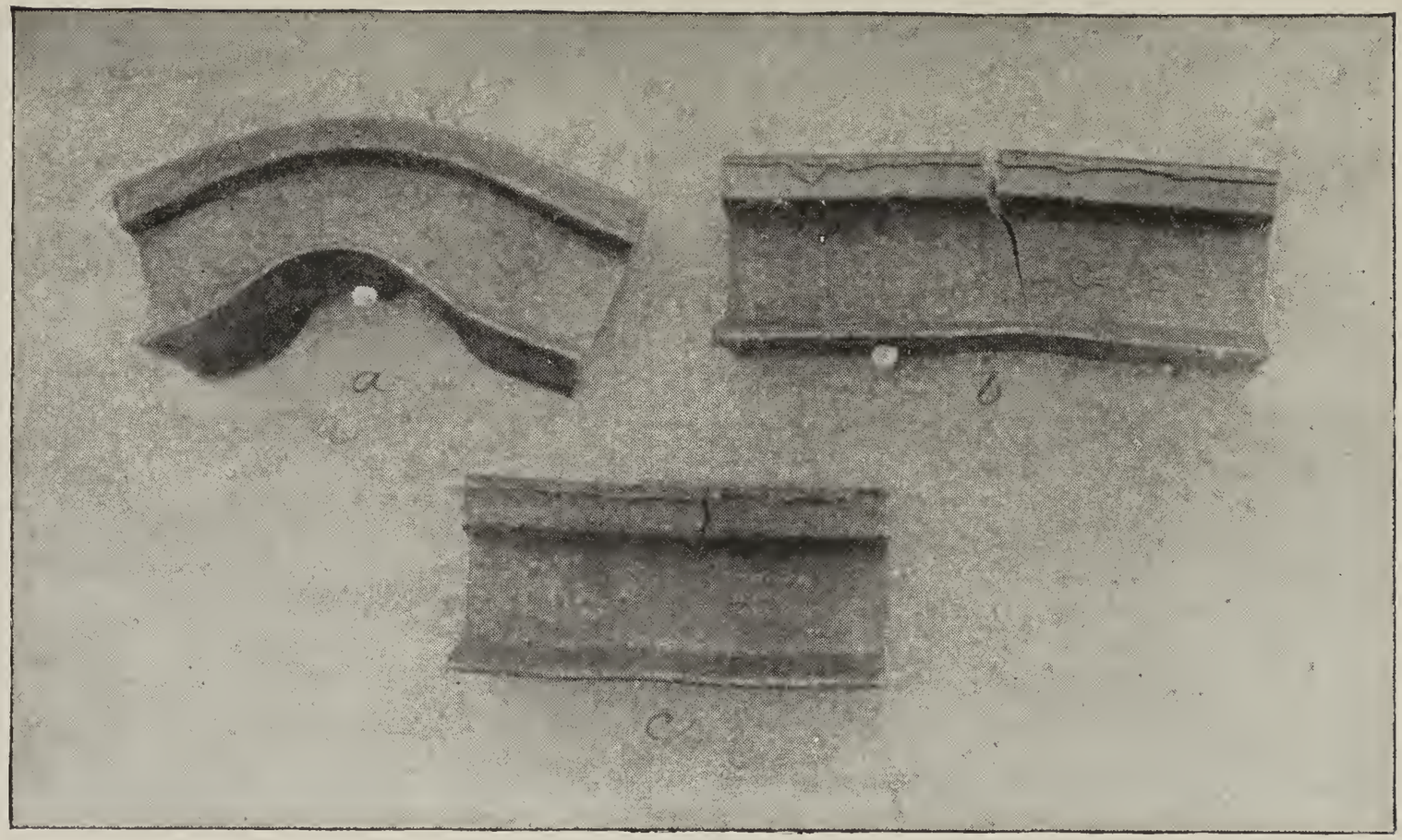
Loaded on the base at the middle.

Ultimate strength, 152,000 pounds.

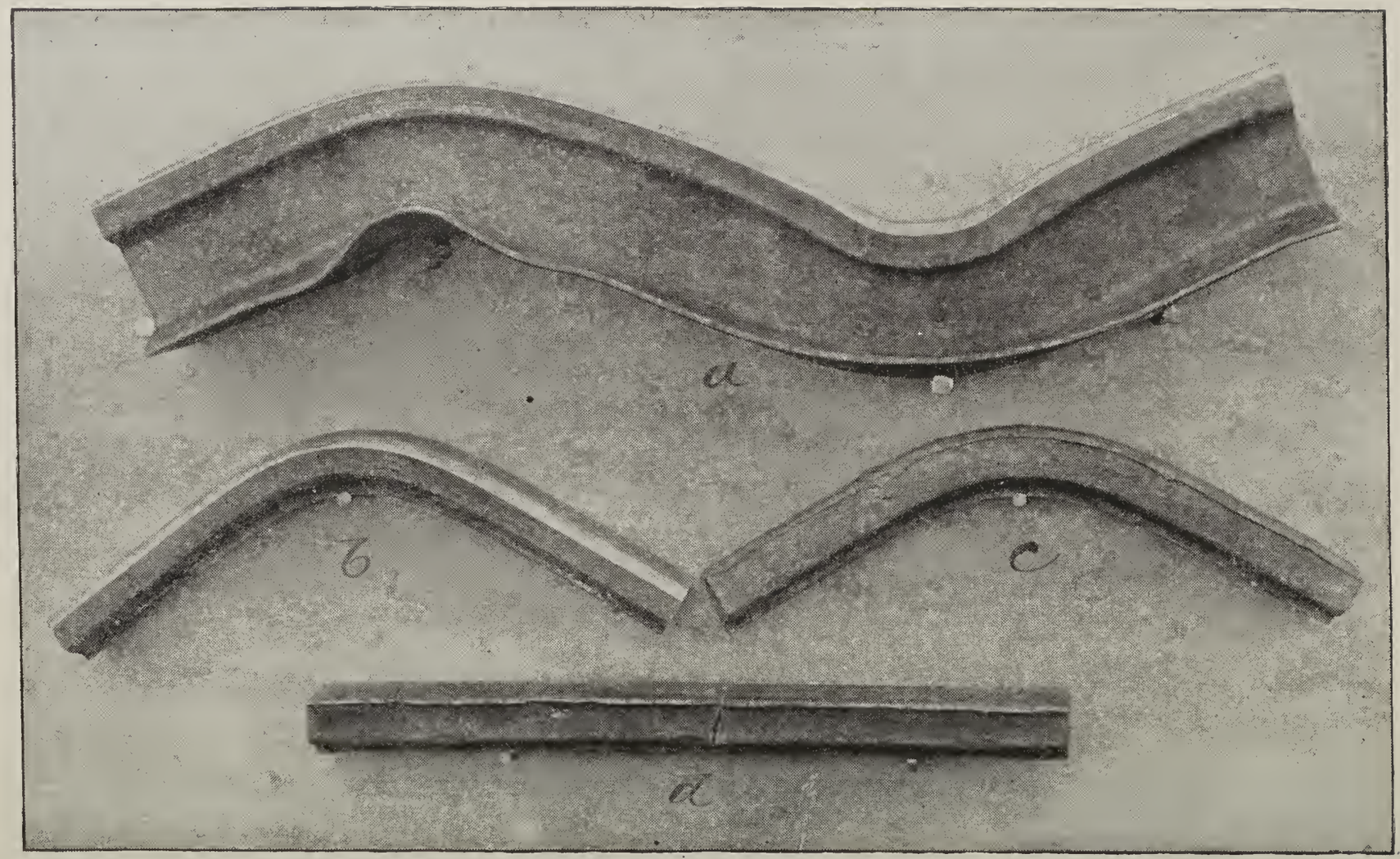
The rail was bent through an angle of 40 degrees without fracture.

No. 72*b*.

Head of the rail of other fractured end cut off, corners rounded at *a a*, and bent 60 degrees without fracture. The upper side of head was on the convex side of the bend.



No. 34.



No. 34.

No. 73.

PIECE OF RAIL NO. 34.

Distance between end bearings, 22″.1 inches. Loaded on head at the middle.

Ultimate strength, 122,100 pounds; R=92,420 pounds per square inch.

Rail bent 38 degrees without fracture.

The head was partly overturned by the pressure during the test, and the web and flanges badly distorted.

No. 73*a*.

HEAD OF RAIL NO. 34.

Bent transversely with top surface of head on the tension side.

Fractured in a brittle manner with a granular appearance; the metal next the top surface showed an oblique sheared appearance.

Piece bent through about 5 degrees before rupture.

No. 73*b*.

HEAD OF RAIL NO. 34.

Annealed at a high scaling heat before testing.

Bent transversely with the top surface of the head on the tension side of the bend.

Bent through 58 degrees without rupture.

No. 76.

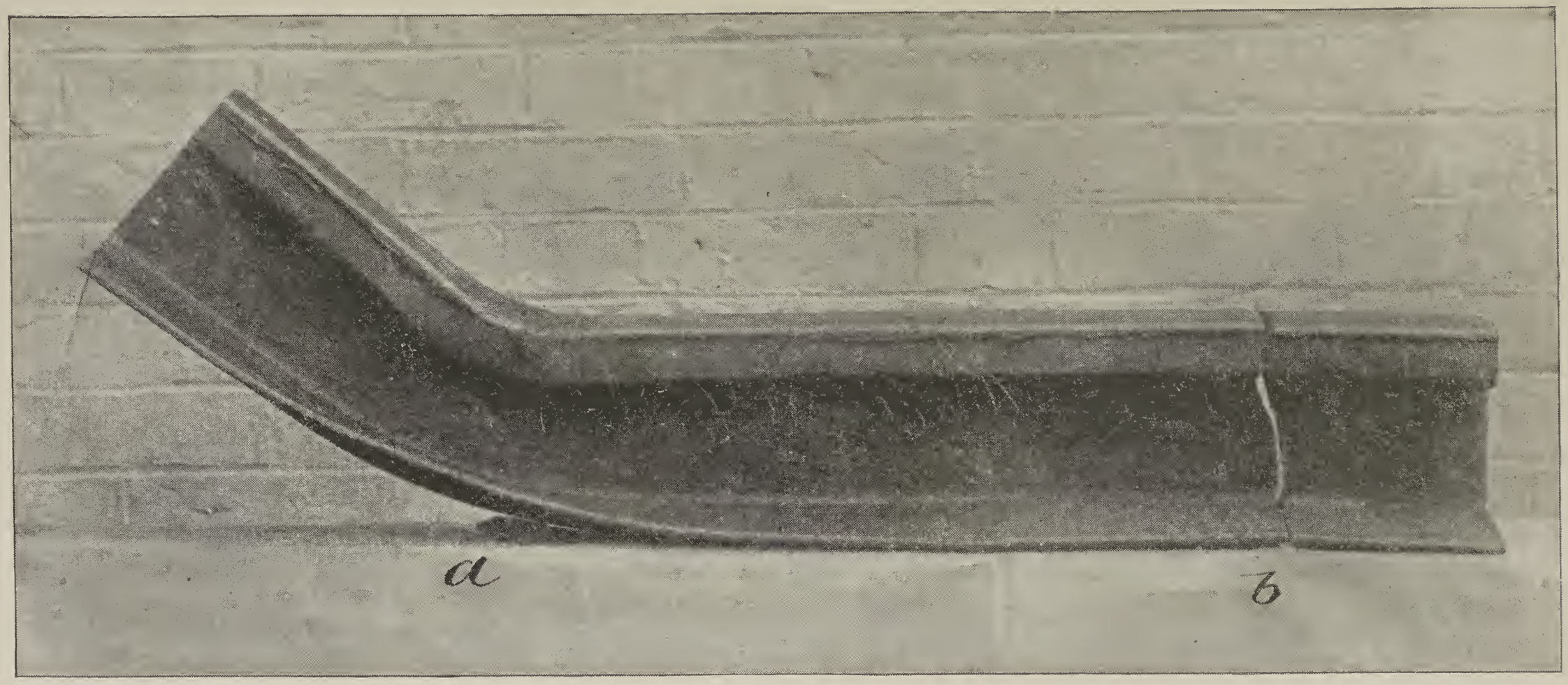
PIECE OF RAIL NO. 34.

Height at middle, 4″.41.
Supported at ends 17″.1 apart.
Loaded on base at the middle.
Ultimate strength, 93,580 pounds; R = 54,810 pounds per square inch.
Granular fracture, radiating from a zone at the top of the head where the metal to a depth of about ″.04 to ″.06 showed a smooth sheared appearance.
The fracture occurred suddenly with slight permanent deflection, the fracture extending through the metal of the head and the web. The base of the rail was not fractured.

No. 77.

PIECE OF RAIL NO. 34.

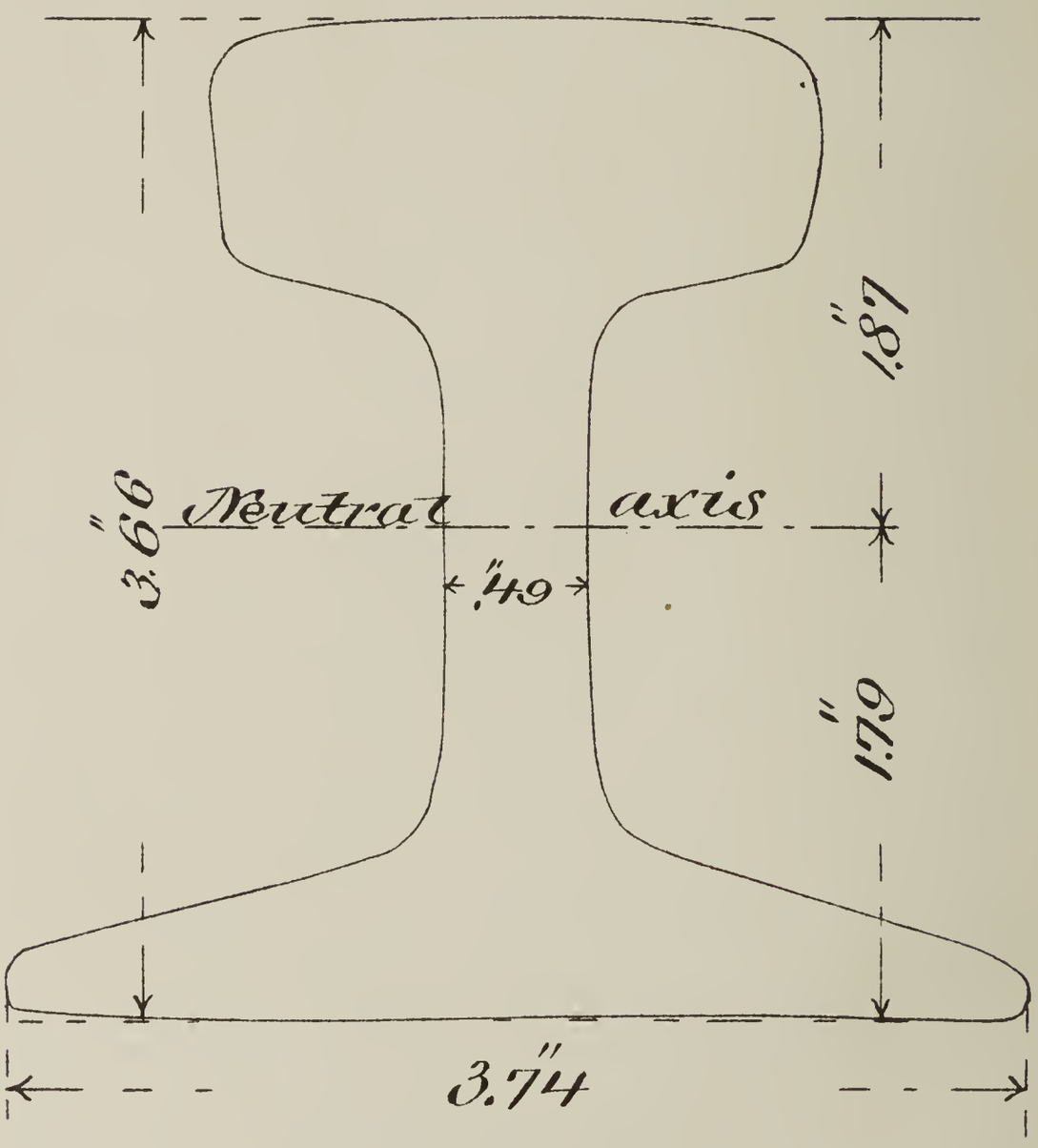
Height at middle, 4″.41.
Supported at ends 22″.1 apart.
Loaded on base at the middle.
This test is made at a distance of 15″ from test No. 73, measuring from center to center of plunger at middle of span.
Ultimate strength, 78,100 pounds; R = 59,120 pounds per square inch.
Granular fracture, with metal ″.04 to ″.06 in depth from the top of the head, displaying a smooth sheared appearance. The rail fractured with slight permanent deflection.



No. 34.

No. 35

Branded "C R M Co. 12 75"



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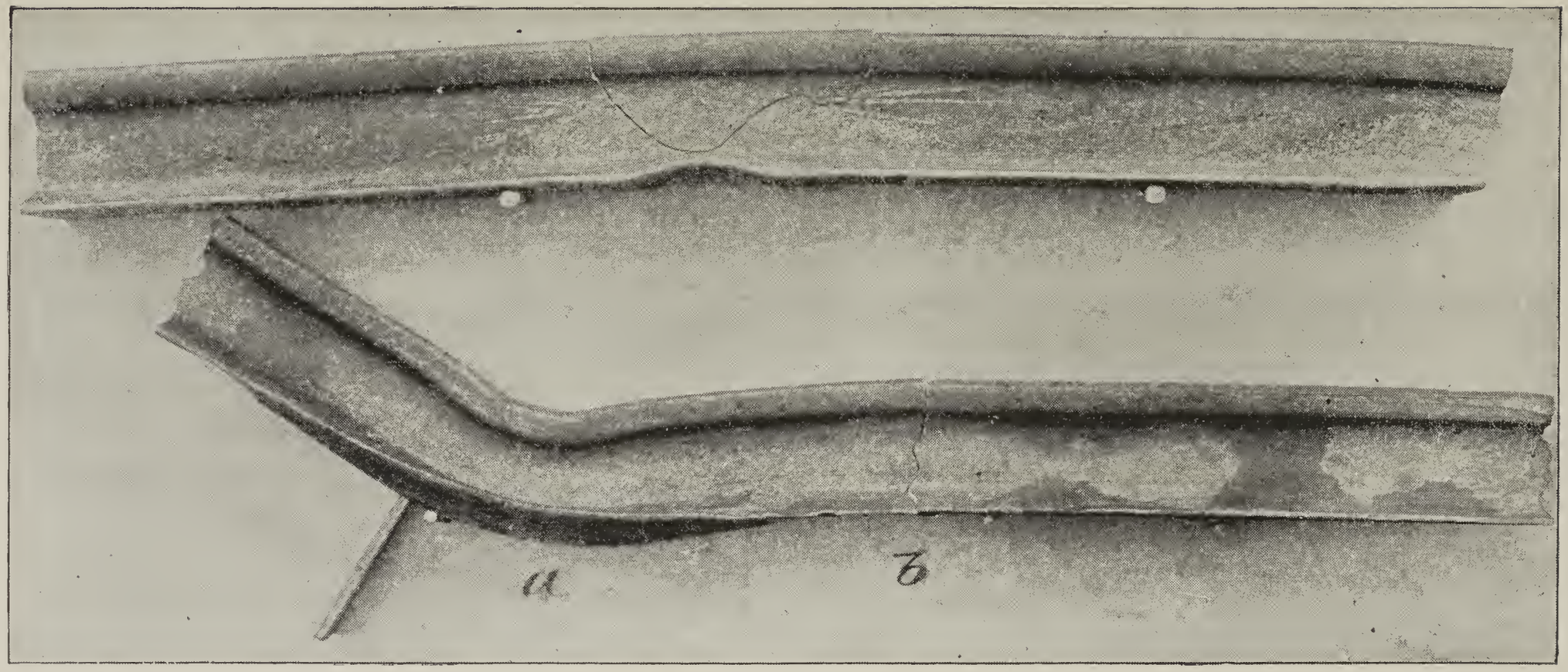


No. 18. No. 35.

No. 88.

Rail No. 35.

Branded "C. R. M. Co., 12, 75."
Height, 3″.66.
Width of base, 3″.74.
Weight per yard, 48.71 pounds.
Ends supported 30″ apart.
Loaded on base at the middle.
One end of this piece of rail was battered down and showed an irregular fracture.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	3,270	0.	0.	0.	Initial load.
4,000	6,530	.0082	.0082	.....	
6,000	9,800	.0162	.0080	.....	
8,000	13,060	.0227	.0065	.....	
10,000	16,330	.0288	.0061	.0002	
12,000	19,590	.0345	.0057	.....	
14,000	22,860	.0404	.0059	.....	
16,000	26,120	.0462	.0058	.....	
18,000	29,390	.0525	.0063	.....	
20,000	32,650	.0578	.0053	.0013	E=20,860,000.
22,000	35,920	.0640	.0062	.....	
24,000	39,180	.0702	.0062	.....	Elastic limit.
26,000	42,450	.0766	.0064	.....	
28,000	45,710	.0835	.0069	.....	
30,000	48,980	.0915	.0080	.0070	
32,000	52,240	.1007	.0092	.....	
34,000	55,510	.1108	.0101	.0151	
36,000	58,770	.12	.0092	.....	
38,000	62,040	.13	.01	.....	
40,000	65,310	.15	.02	.....	
42,000	68,570	.19	.04	.....	
44,000	71,840	.24	.05	.....	
46,000	75,100	.30	.06	.....	
48,000	78,370	.37	.07	.....	
50,000	81,630	.44	.07	.....	
50,800	82,940	.....	.....	.....	Ultimate strength.

Granular appearance, radiating from metal having a sheared appearance, where flow has occurred under the wheel pressures, at the outside of the head.

No. 90.

Rail No. 35.

Height, 3″.66.
Width of base, 3″.67.
Ends supported, 17″.1 apart.
Loaded on head at the middle.
Ultimate strength, 126,800 pounds; R=118,010 pounds per square inch.
Bent through an angle of 42 degrees without fracture.

No. 86.

Steel Rail No. 36.

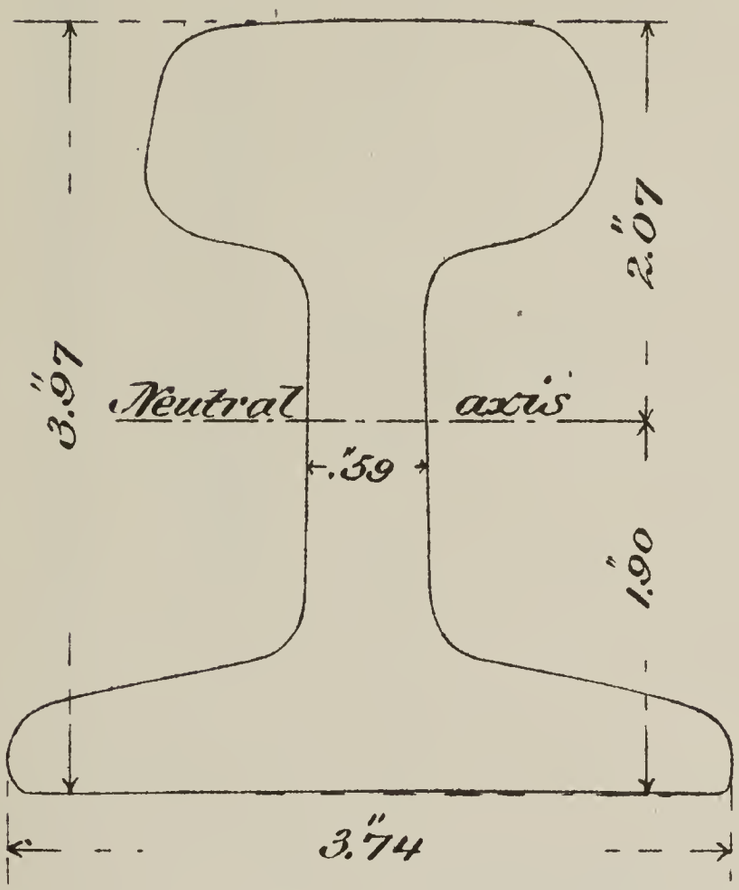
Branded "Wilson Cammel Cos. Steel, Sec. $\frac{6}{74}$, Dronfield."
Height, 3″.97.
Width of base, 3″.74.
Weight per yard, 60.69 pounds.
Ends supported 30″ apart. Loaded on base at the middle.

Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inches.*	*Inch.*	*Inch.*	
2,000	2,600	0.	0.	0.	Initial load.
4,000	5,200	.0052	.0052	.....	
6,000	7,800	.0100	.0048	.....	
8,000	10,390	.0142	.0042	.....	
10,000	12,990	.0185	.0043	.0002	
12,000	15,590	.0228	.0043	.....	
14,000	18,190	.0269	.0041	.....	
16,000	20,790	.0310	.0041	.....	
18,000	23,390	.0350	.0040	.....	
20,000	25,990	.0391	.0041	.0005	
22,000	28,580	.0431	.0040	.....	
24,000	31,180	.0470	.0039	.....	
26,000	33,780	.0510	.0040	.....	
28,000	36,380	.0548	.0038	.....	
30,000	38,980	.0587	.0039	.0010	E = 22,840,000.
32,000	41,580	.0630	.0043	.....	
34,000	44,170	.0670	.0040	.....	
36,000	46,770	.0708	.0038	.....	
38,000	49,370	.0748	.0040	.....	
40,000	51,970	.0788	.0040	.0021	Elastic limit.
42,000	54,570	.0835	.0047	.....	
44,000	57,170	.0874	.0039	.....	
46,000	59,770	.0920	.0046	.....	
48,000	62,360	.0966	.0046	.....	
50,000	64,960	.1017	.0051	.0059	
52,000	67,560	.1070	.0053	.....	
54,000	70,160	.1128	.0058	.....	
56,000	72,760	.1193	.0065	.0130	
58,000	75,360	.13	.0107	.....	
60,000	77,960	.14	.01	.....	
62,000	80,550	.15	.01	.....	
64,000	83,150	.16	.01	.....	
66,000	85,750	.17	.01	.....	
68,000	88,350	.18	.01	.....	
70,000	90,950	.20	.02	.....	
72,000	93,550	.23	.03	.....	
74,000	96,150	.27	.04	.....	
76,000	98,740	.31	.04	.....	
78,000	101,340	.36	.05	.....	
80,000	103,940	.40	.04	.....	
82,000	106,540	.45	.05	.....	
84,000	109,140	.51	.06	.....	
86,000	111,740	.56	.05	.....	
88,000	114,340	.64	.08	.....	
90,000	116,930	.69	.05	.....	
100,000	129,930	1.14	.45	.....	
109,200	141,880	.....	.....	.....	Ultimate strength.

Granular fracture, radiating from a point on the top of the rail where the metal had flowed slightly under the wheel pressures.

Nos. 36 & 37

"Wilson Cammel Cos Steel Sec 6/74 Dronfield"



No. 87.

Steel Rail No. 37.

Branded "Wilson Cammel Cos. Steel, Sec. $\frac{6}{74}$ Dronfield."
Height, 3″.97.
Width of base, 3″.72.
Weight per yard, 60.62 pounds.
Ends supported 30″ apart.
Loaded on base at the middle.

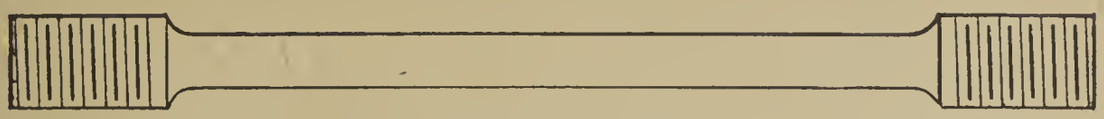
Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
2,000	2,600	0.	0.	0.	Initial load.
4,000	5,200	.0043	.0043	.....	
6,000	7,800	.0087	.0044	.....	
8,000	10,390	.0128	.0041	.....	
10,000	12,990	.0168	.0040	.0004	
12,000	15,590	.0208	.0040	.....	
14,000	18,190	.0248	.0040	.....	
16,000	20,790	.0288	.0040	.....	
18,000	23,390	.0328	.0040	.....	
20,000	25,990	.0368	.0040	.0010	
22,000	28,580	.0410	.0042	.....	
24,000	31,180	.0448	.0038	.....	
26,000	33,780	.0488	.0040	.....	
28,000	36,380	.0526	.0038	.....	
30,000	38,980	.0565	.0039	.0015	
32,000	41,580	.0605	.0040	.....	
34,000	44,170	.0643	.0038	.....	
36,000	46,770	.0682	.0039	.....	
38,000	49,370	.0721	.0039	.....	
40,000	51,970	.0761	.0040	.0028	E = 24,400,000.
42,000	54,570	.0803	.0042	.....	
44,000	57,170	.0845	.0042	.....	Elastic limit.
46,000	59,770	.0894	.0049	.....	
48,000	62,360	.0941	.0047	.....	
50,000	64,960	.0997	.0056	.0079	
52,000	67,560	.1068	.0071	.....	
54,000	70,160	.1150	.0082	.....	
56,000	72,760	.1248	.0098	.....	
58,000	75,360	.1332	.0084	.....	
60,000	77,960	.1610	.0278	.0464	
62,000	80,550	.18	.019	.....	
64,000	83,150	.20	.02	.....	
66,000	85,750	.23	.03	.....	
68,000	88,350	.28	.05	.....	
70,000	90,950	.33	.05	.....	
72,000	93,550	.38	.05	.....	
74,000	96,150	.44	.06	.....	
76,000	98,740	.49	.05	.....	
78,000	101,340	.56	.07	.....	
80,000	103,940	.64	.08	.....	
82,000	106,540	.72	.08	.....	
84,000	109,140	.80	.08	.....	
85,900	111,610	.....	.....	.....	Ultimate strength.

Granular fracture, radiating from a point on the surface of the head, where there was a slight indication of flow of the metal under the wheel pressures.

In this test and in test No. 86 the center of radiation was at the outer side of the head as the rail lay in the track.

SECTIONS OF RAILS FROM WHICH NO TRANSVERSE TESTS WERE MADE.

TENSION TESTS OF SPECIMENS TAKEN FROM HEADS OF STEEL RAILS.



Form of specimens.

No. 4466.

Rail No. 8.

Diameter, 1.″128.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0014	.....	
10,000	10,000	.0032	.....	
20,000	20,000	.0067	.....	
30,000	30,000	.0101	0.	
35,000	35,000	.0120	.....	
39,000	39,000	.0134	.....	Elastic limit.
40,000	40,000	.0142	.0009	
41,000	41,000	.0160	.....	
42,000	42,000	.0169	.....	
43,000	43,000	.0510	.....	
44,000	44,000	.0578	.....	
45,000	45,000	.0640	.....	
46,000	46,000	.0730	.....	
47,000	47,000	.0810	.....	
48,000	48,000	.0880	.....	
49,000	49,000	.0980	.....	
50,000	50,000	.1100	.....	
52,000	52,000	.1290	.....	
54,000	54,000	.1485	.....	
56,000	56,000	.1730	.....	
58,000	58,000	.1940	.....	
60,000	60,000	.2175	.....	
62,000	62,000	.25	.....	
64,000	64,000	.28	.....	
66,000	66,000	.31	.....	
68,000	68,000	.35	.....	
70,000	70,000	.39	.....	
72,000	72,000	.44	.....	
74,000	74,000	.49	.....	
76,000	76,000	.56	.....	
78,000	78,000	.63	.....	
80,000	80,000	.73	.....	
82,000	82,000	.85	.....	
84,000	84,000	1.10	.....	
85,660	85,660	1.67	.....	Tensile strength.
76,500	76,500	.....	.....	At time of rupture.
0	0	2.06	.....	=20.6 per cent.

Elongation of inch sections: ″.13, ″.15, ″.19, ″.23, ″.48*, ″.23, ″.19, ″.17, ″.15, ″.14.

Diameter at fracture, ″.87. Area, .594 square inch.

Contraction of area, 40.6 per cent.

Fractured 5″.7 from the neck. Appearance, silky, interspersed with fine granulation at the circumference.

No. 4477.

Rail No. 9.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0011	.....	
5,000	10,000	.0031	.....	
10,000	20,000	.0062	.....	
14,000	28,000	.0096	.....	
14,500	29,000	.0099	.....	Elastic limit.
15,000	30,000	.0119	.0017	
15,500	31,000	.0130	.....	
16,000	32,000	.0142	.....	
16,500	33,000	.0172	.....	
17,000	34,000	.0270	.....	
17,500	35,000	.0417	.0294	
18,000	36,000	.0516	.....	
18,500	37,000	.0567	.....	
19,000	38,000	.0630	.....	
19,500	39,000	.0712	.....	
20,000	40,000	.0790	.....	
20,500	41,000	.0875	.....	
21,000	42,000	.0950	.....	
21,500	43,000	.1040	.....	
22,000	44,000	.1135	.....	
22,500	45,000	.1230	.....	
23,000	46,000	.1320	.....	
23,500	47,000	.1430	.....	
24,000	48,000	.1550	.....	
24,500	49,000	.1640	.....	
25,000	50,000	.1750	.....	
25,500	51,000	.1860	.....	
26,000	52,000	.2000	.....	
26,500	53,000	.2120	.....	
27,000	54,000	.2275	.....	
27,500	55,000	.2410	.....	
28,000	56,000	.2550	.....	
28,500	57,000	.27	.....	
29,000	58,000	.29	.....	
29,500	59,000	.31	.....	
30,000	60,000	.33	.....	
30,500	61,000	.35	.....	
31,000	62,000	.37	.....	
31,500	63,000	.39	.....	
32,000	64,000	.41	.....	
32,500	65,000	.44	.....	
33,000	66,000	.47	.....	
33,500	67,000	.51	.....	
34,000	68,000	.54	.....	
34,500	69,000	.58	.....	
35,000	70,000	.63	.....	
35,500	71,000	.69	.....	
36,000	72,000	.75	.....	
36,500	73,000	.83	.....	
37,000	74,000	.94	.....	
37,500	75,000	1.05	.....	
38,000	76,000	1.31	.....	
38,120	76,240	1.61	.....	Tensile strength.
36,280	.....	.....	.....	At time of rupture.
0	0	2.00	.....	=20 per cent.

Elongation of inch sections: ″.14, ″.17, ″.19, ″.21, ″.36*, ″.25, ″.18, ″.19, ″.18, ″.13.

Diameter at fracture, ″.66. Area, .342 square inch.

Contraction of area, 31.6 per cent.

Fractured at middle of stem. Appearance, granular 90 per cent, silky spot at circumference 10 per cent. Opened cracks in surface of stem in vicinity of silky spot.

No. 4470.

Rail No. 10.

Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	.0	0.	Initial load.
5,000	5,000	.0012	----------	
10,000	10,000	.0028	----------	
20,000	20,000	.0062	----------	
30,000	30,000	.0095	0.	
35,000	35,000	.0112	----------	
40,000	40,000	.0130	0.	
45,000	45,000	.0151	----------	
46,000	46,000	.0157	----------	
47,000	47,000	.0160	----------	
48,000	48,000	.0165	----------	
49,000	49,000	.0170	----------	
50,000	50,000	.0175	.0010	
51,000	51,000	.0181	----------	Elastic limit. (Not well defined.)
52,000	52,000	.0190	----------	
53,000	53,000	.0198	----------	
54,000	54,000	.0206	----------	
55,000	55,000	.0216	----------	
56,000	56,000	.0264	----------	
57,000	57,000	.0345	----------	
58,000	58,000	.0418	----------	
59,000	59,000	.0458	----------	
60,000	60,000	.0506	----------	
62,000	62,000	.0612	----------	
64,000	64,000	.0720	----------	
66,000	66,000	.0850	----------	
68,000	68,000	.0990	----------	
70,000	70,000	.1140	----------	
72,000	72,000	.1280	----------	
74,000	74,000	.1430	----------	
76,000	76,000	.1580	----------	
78,000	78,000	.1745	----------	
80,000	80,000	.1930	----------	
84,000	84,000	.23	----------	
88,000	88,000	.27	----------	
92,000	92,000	.32	----------	
96,000	96,000	.37	----------	
100,000	100,000	.45	----------	
104,000	104,000	.54	----------	
108,000	108,000	.70	----------	
111,080	111,080	1.13	----------	Tensile strength.
101,500	----------	----------	----------	At time of rupture.
0	0	1.37	----------	=13.7 per cent.

Elongation of inch sections: ″.07, ″.11, ″.13, ″.13, ″.32*, ″.22, ″.12, ″.10, ″.09, ″.08.
Diameter at fracture, ″.94. Area, .694 square inch.
Contraction of area, 30.6 per cent.
Fractured 5″.5 from the neck. Appearance, fine granular, silky center.

No. 4471.

Rail No. 11.

Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches,*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0012	.....	
10,000	10,100	.0030	.....	
20,000	20,000	.0064	.....	
30,000	30,000	.0101	0.	
35,000	35,000	.0118	.....	
40,000	40,000	.0137	.0002	
45,000	45,000	.0153	.....	
46,000	46,000	.0158	.....	
47,000	47,000	.0162	.....	
48,000	48,000	.0168	.....	
49,000	49,000	.0173	.....	
50,000	50,000	.0179	.0012	Elastic limit.
51,000	51,000	.0188	.....	
52,000	52,000	.0194	.....	
53,000	53,000	.0203	.....	
54,000	54,000	.0230	.....	
55,000	55,000	.0340	.....	
56,000	56,000	.0540	.....	
57,000	57,000	.0620	.....	
58,000	58,000	.0690	.....	
59,000	59,000	.0760	.....	
60,000	60,000	.0848	.....	
62,000	62,000	.0990	.....	
64,000	64,000	.1160	.....	
66,000	66,000	.1325	.....	
68,000	68,000	.1480	.....	
70,000	70,000	.1675	.....	
72,000	72,000	.1870	.....	
74,000	74,000	.2075	.....	
76,000	76,000	.2270	.....	
80,000	80,000	.28	.....	
84,000	84,000	.33	.....	
88,000	88,000	.39	.....	
92,000	92,000	.49	.....	
96,000	96,090	.61	.....	
100,000	100,000	.83	.....	
101,660	101,660	1.16	.....	Tensile strength.
87,200	.....	.....	.....	At time of rupture.
0	0	1.63	.....	=16.3 per cent.

Elongation of inch sections: ″.09, ″.11, ″.13, ″.12, ″.15, ″.41*, ″.26, ″.15, ″.12, ″.09.

Diameter at fracture, ″.86. Area, .581 square inch.

Contraction of area, 41.9 per cent.

Fractured 5″ from the neck. Appearance, silky, interspersed with fine granulation.

No. 4472.

RAIL NO. 12.

Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0013	.....	
10,000	10,000	.0030	.....	
20,000	20,000	.0064	.....	
30,000	30,000	.0100	.....	
35,000	35,000	.0115	.....	
40,000	40,000	.0132	0.	
45,000	45,000	.0150	.....	
50,000	50,000	.0170	.0002	
51,000	51,000	.0173	.....	
52,000	52,000	.0179	.....	
53,000	53,000	.0182	.....	
54,000	54,000	.0188	.....	
55,000	55,000	.0192	.....	
56,000	56,000	.0198	.....	
57,000	57,000	.0203	.....	Elastic limit.
58,000	58,000	.0212	.....	
59,000	59,000	.0230	.....	
60,000	60,000	.0310	.....	
62,000	62,000	.0531	.....	
64,000	64,000	.0640	.....	
66,000	66,000	.0770	.....	
68,000	68,000	.0900	.....	
70,000	70,000	.1030	.....	
72,000	72,000	.1160	.....	
74,000	74,000	.1300	.....	
76,000	76,000	.1440	.....	
78,000	78,000	.1590	.....	
80,000	80,000	.1735	.....	
84,000	84,000	.21	.....	
88,000	88,000	.24	.....	
92,000	92,000	.28	.....	
96,000	96,000	.34	.....	
100,000	100,000	.39	.....	
104,000	104,000	.47	.....	
108,000	108,000	.57	.....	
112,000	112,000	.77	.....	
113,990	113,990	1.15	.....	Tensile strength.
102,900	.....	.....	.....	At time of fracture.
0	0	1.55	.....	=15.5 per cent.

Elongation of inch sections: ″.09, ″.12, ″.15, ″.16, ″.35*, ″.20, ″.14, ″.13, ″.13, ″.08.

Diameter at fracture, ″.94. Area, .694 square inch.

Contraction of area, 30.6 per cent.

Fractured 5″.6 from the neck. Appearance, fine granular, silky center.

No. 4473.

Rail No. 13.

Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0013	.....	
10,000	10,000	.0031	.....	
20,000	20,000	.0066	.....	
30,000	30,000	.0101	0.	
35,000	35,000	.0118	.....	
40,000	40,000	.0133	0.	
45,000	45,000	.0152	.....	
46,000	46,000	.0158	.....	
47,000	47,000	.0162	.....	
48,000	48,000	.0168	.....	
49,000	49,000	.0172	.....	Elastic limit.
50,000	50,000	.0180	.0008	
51,000	51,000	.0202	.....	
52,000	52,000	.0410	.....	
53,000	53,000	.0525	.....	
54,000	54,000	.0600	.....	
55,000	55,000	.0680	.....	
56,000	56,000	.0751	.....	
57,000	57,000	.0830	.....	
58,000	58,000	.0912	.....	
59,000	59,000	.0990	.....	
60,000	60,000	.1070	.....	
62,000	62,000	.1240	.....	
64,000	64,000	.1400	.....	
66,000	66,000	.1575	.....	
68,000	68,000	.1770	.....	
70,000	70,000	.1960	.....	
72,000	72,000	.2180	.....	
76,000	76,000	.26	.....	
80,000	80,000	.31	.....	
84,000	84,000	.38	.....	
88,000	88,000	.47	.....	
92,000	92,000	.57	.....	
96,000	96,000	.77	.....	
99,420	99,420	1.45	.....	Tensile strength.
89,800	.....	.....	.....	At time of fracture.
0	0	1.69	.....	= 16.9 per cent.

Elongation of inch sections: ″.09, ″.12, ″.12, ″.17, ″.23, ″.37*, ″.18, ″.15, ″.15, ″.11.

Diameter at fracture, ″.92. Area, .665 square inch.

Contraction of area, 33.5 per cent.

Fractured at middle of stem. Appearance, granular, radiating from a silky spot at the circumference. A series of transverse cracks opened along the stem.

No. 4474.

RAIL No. 14.

Diameter 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0012	.....	
10,000	10,000	.0030	.....	
20,000	20,000	.0062	.....	
30,000	30,000	.0098	.....	
40,000	40,000	.0133	0.	
45,000	45,000	.0152	.....	
46,000	46,000	.0158	.....	
47,000	47,000	.0163	.....	
48,000	48,000	.0169	.....	
49,000	49,000	.0174	.....	
50,000	50,000	.0178	.0011	Elastic limit.
51,000	51,000	.0190	.....	
52,000	52,000	.0200	.....	
53,000	53,000	.0212	.....	
54,000	54,000	.0248	.....	
55,000	55,000	.0285	.....	
56,000	56,000	.0328	.....	
57,000	57,000	.0375	.....	
58,000	58,000	.0425	.....	
59,000	59,000	.0470	.....	
60,000	60,000	.0520	.....	
62,000	62,000	.0625	.....	
64,000	64,000	.0750	.....	
66,000	66,000	.0900	.....	
68,000	68,000	.1058	.....	
70,000	70,000	.1200	.....	
72,000	72,000	.1360	.....	
74,000	74,000	.1490	.....	
76,000	76,000	.1670	.....	
78,000	78,000	.1840	.....	
80,000	80,000	.2000	.....	
84,000	84,000	.23	.....	
88,000	88,000	.28	.....	
92,000	92,000	.32	.....	
96,000	96,000	.29	.....	
100,000	100,000	.48	.....	
104,000	104,000	.60	.....	
108,000	108,000	.83	.....	
109,200	109,200	.....	.....	Tensile strength.
0	0	.79	.....	= 7.9 per cent.

Elongation of inch sections: ″.06, ″.09, ″.08, ″.09, ″.08, ″.07, ″.09, ″.08, ″.08, ″.07.

Minimum diameter, 1″.08. Area, .916 square inch.

Contraction, 8.4 per cent.

Fractured the head at root of thread, the diameter being 1.″36. Appearance, granular.

No. 4459.

Rail No. 15.

Diameter, ″.714.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0013	0.	
4,000	10,000	.0031	.....	
6,000	15,000	.0049	.....	
8,000	20,000	.0068	0.	
10,000	25,000	.0084	.....	
12,000	30,000	.0102	0.	
14,000	35,000	.0120	0.	
16,000	40,009	.0137	0.	
18,000	45,000	.0153	0.	
20,000	50,000	.0170	0.	
20,400	51,000	.0176	.....	
20,800	52,000	.0179	.....	
21,200	53,000	.0182	.....	
21,600	54,000	.0186	.....	
22,000	55,000	.0191	0.	
22,400	56,000	.0193	.....	
22,800	57,000	.0199	.....	Elastic limit.
23,200	58,000	.0278	.....	
23,600	59,000	.0330	.....	
24,000	60,000	.0412	.0187	
24,800	62,000	.0530	.....	
25,600	64,000	.0663	.....	
26,400	66,000	.0802	.....	
27,200	68,000	.0948	.....	
28,000	70,000	.1082	.....	
28,800	72,000	.1258	.....	
29,600	74,000	.1380	.....	
30,400	76,000	.1560	.....	
31,200	78,000	.1720	.....	
32,000	80,000	.1909	.1560	
32,800	82,000	.21	.....	
33,600	84,000	.23	.....	
34,400	86,000	.25	.....	
35,200	88,000	.27	.....	
36,000	90,000	.30	.....	
36,800	92,000	.32	.....	
37,600	94,000	.34	.....	
38,400	96,000	.38	.....	
39,200	98,000	.42	.....	
40,000	100,000	.45	.....	
40,800	102,000	.50	.....	
41,600	104,000	.56	.....	
42,400	106,000	.63	.....	
43,200	108,000	.72	.....	
44,000	110,000	.87	.....	
44,720	111,800	1.36	.....	Tensile strength.
41,400	.....	.....	.....	At time of fracture.
0	0	1.45	.....	=14.5 per cent.

Elongation of inch sections: ″.08, ″.12, ″.12, ″.17 ″.14, ″.18, ″.26*, ″14, ″.13, ″.11.
Diameter at fracture, ″.60. Area, .283 square inch.
Contraction of area, 29.3 per cent.
Fractured 4″.2 from the neck. Appearance, granular.

No. 4475.

Rail No. 16.

Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0013	.....	
10,000	10,000	.0031	.....	
20,000	20,000	.0064	.....	
30,000	30,000	.0100	.....	
40,000	40,000	.0132	0.	
45,000	45,000	.0150	.....	
46,000	46,000	.0154	.....	
47,000	47,000	.0158	.....	
48,000	48,000	.0162	.....	
49,000	49,000	.0167	.....	
50,000	50,000	.0170	.0002	
51,000	51,000	.0175	.....	
52,000	52,000	.0180	.....	
53,000	53,000	.0184	.....	Elastic limit.
54,000	54,000	.0192	.....	
55,000	55,000	.0203	.....	
56,000	56,000	.0240	.....	
57,000	57,000	.0365	.....	
58,000	58,000	.0440	.....	
59,000	59,000	.0500	.....	
60,000	60,000	.0561	.....	
62,000	62,000	.0685	.....	
64,000	64,000	.0820	.....	
66,000	66,000	.0950	.....	
68,000	68,000	.1080	.....	
70,000	70,000	.1228	.....	
72,000	72,000	.1360	.....	
74,000	74,000	.1505	.....	
76,000	76,000	.1660	.....	
78,000	78,000	.1810	.....	
80,000	80,000	.2000	.....	
84,000	84,000	.24	.....	
88,000	88,000	.28	.....	
92,000	92,000	.34	.....	
96,000	96,000	.38	.....	
100,000	100,000	.45	.....	
104,000	104,000	.55	.....	
108,000	108,000	.72	.....	
111,880	111,880	1.26	.....	Tensile strength.
101,600	.....	.....	.....	At time of rupture.
0	0	1.52	.....	=15.2 per cent.

Elongation of inch sections: ″.09, ″.14, ″.16, ″.15, ″.31*, ″.22, ″.14, ″.12, ″.11, ″.08.

Diameter at fracture, ″.49. Area, .694 square inch.

Contraction of area, 30.6 per cent.

Fractured 5″.6 from the neck. Appearance, fine granular, silky center.

No. 4476.

Rail No. 17.

Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0013	.....	
10,000	10,000	.0031	.....	
20,000	20,000	.0066	.....	
30,000	30,000	.0100	.....	
35,000	35,000	.0118	.....	
40,000	40,000	.0136	0.	
45,000	45,000	.0154	.....	
46,000	46,000	.0160	.....	
47,000	47,000	.0164	.....	
48,000	48,000	.0169	.....	
49,000	49,000	.0172	.....	
50,000	50,000	.0178	.0009	
51,000	51,000	.0182	.....	
52,000	52,000	.0187	.....	
53,000	53,000	.0192	.....	
54,000	54,000	.0197	.....	
55,000	55,000	.0202	.0019	Elastic limit. (Not well defined.)
56,000	56,000	.0212	.....	
57,000	57,000	.0220	.....	
58,000	58,000	.0235	.....	
59,000	59,000	.0253	.....	
60,000	60,000	.0345	.....	
62,000	62,000	.0610	.....	
64,000	64,000	.0730	.....	
66,000	66,000	.0865	.....	
68,000	68,000	.1012	.....	
70,000	70,000	.1140	.....	
72,000	72,000	.1275	.....	
74,000	74,000	.1440	.....	
76,000	76,000	.1590	.....	
78,000	78,000	.1750	.....	
80,000	80,000	.1912	.....	
84,000	84,000	.23	.....	
88,000	88,000	.27	.....	
92,000	92,000	.31	.....	
96,000	96,000	.37	.....	
100,000	100,000	.44	.....	
104,000	104,000	.53	.....	
108,000	108,000	.67	.....	
111,380	111,380	1.17	.....	Tensile strength.
101,900	.....	.....	.....	At time of rupture.
0	0	1.39	.....	=13.9 per cent.

Elongation of inch sections: ″.09, ″.12, ″.12, ″.16, ″.31*, ″.18, ″.13, ″.10, ″.11, ″.07.

Diameter at fracture, ″.94. Area, .694 square inch.

Contraction of area, 30.6 per cent.

Fractured 5″.4 from the neck. Appearance, fine granular, silky center.

No. 4453.

RAIL NO. 18.

Diameter ″.714.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0013	.....	
4,000	10,000	.0032	.....	
6,000	15,000	.0050	.....	
8,000	20,000	.0067	.....	
10,000	25,000	.0082	.....	
12,000	30,000	.0100	0.	
12,400	31,000	.0103	.....	
12,800	32,000	.0107	.....	
13,200	33,000	.0111	.....	
13,600	34,000	.0114	.....	
14,000	35,000	.0117	0.	
14,400	36,000	.0120	.....	
14,800	37,000	.0123	.....	
15,200	38,000	.0128	.....	
15,600	39,000	.0131	.....	
16,000	40,000	.0133	0.	
16,400	41,000	.0137	.....	
16,800	42,000	.0140	.....	
17,200	43,000	.0143	.....	
17,600	44,000	.0148	.....	
18,000	45,000	.0150	0.	
18,400	46,000	.0153	.....	
18,800	47,000	.0158	.....	
19,200	48,000	.0161	.....	
19,600	49,000	.0165	.....	
20,000	50,000	.0168	0.	
20,400	51,000	.0171	.....	
20,800	52,000	.0176	.....	
21,200	53,000	.0179	.....	
21,600	54,000	.0183	.....	Elastic limit.
22,000	55,000	.0190	.0005	
22,400	56,000	.0230	.....	
		.0310	.....	After 2 minutes.
22,800	57,000	.0605	.....	
23,200	58,000	.0795	.....	
23,600	59,000	.0882	.....	
24,000	60,000	.0990	.....	
24,800	62,000	.1245	.....	
25,600	64,000	.1520	.....	
26,400	66,000	.1810	.....	
27,200	68,000	.2100	.....	
28,000	70,000	.2468	.....	
28,800	72,000	.27	.....	
29,600	74,000	.32	.....	
30,400	76,000	.37	.....	
31,200	78,000	.42	.....	
32,000	80,000	.49	.....	
32,800	82,000	.56	.....	
33,600	84,000	.67	.....	
34,400	86,000	.77	.....	
35,200	88,000	1.00	.....	
35,780	89,450	1.37	.....	Tensile strength.
29,700	.....	.....	.....	At time of rupture.
0	0	1.69	.....	= 16.9 per cent.

Elongation of inch sections: ″.10, ″.14, ″.15, ″.22, ″.40*, ″.16, ″.17, ″.15, ″.11, ″.09.

Diameter at fracture, ″.52. Area, .2124 square inch.

Contraction of area, 46.9 per cent.

Fractured 5″ from the neck. Appearance, silky, interspersed with granulation radiating from the center.

No. 4485.

Rail No. 19.

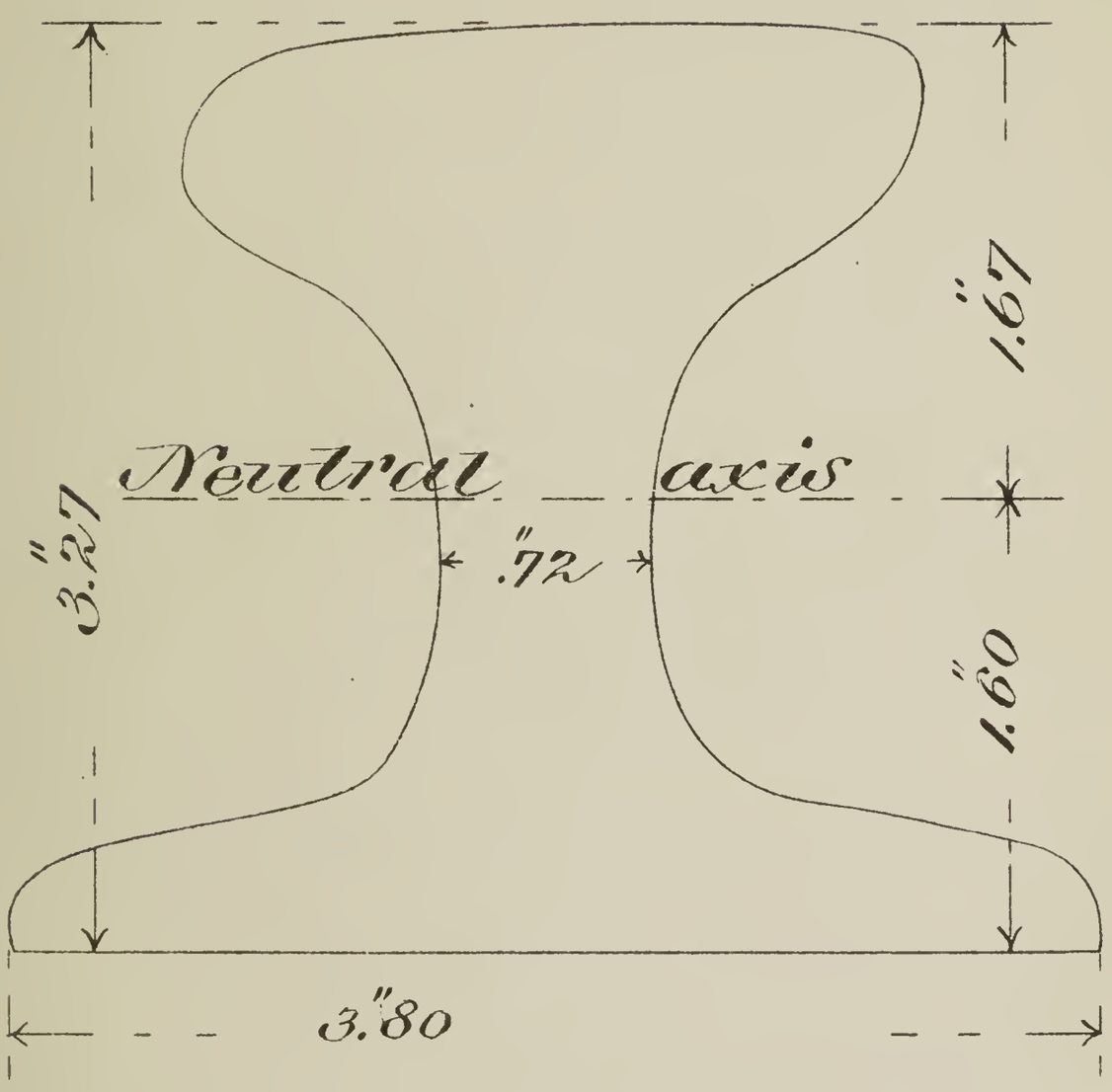
Diameter, ″.874.
Sectional area, .60 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
600	1,000	0.	0.	Initial load.
3,000	5,000	.0012	0.	
6,000	10,000	.0031	.....	
9,000	15,000	.0050	.....	
12,000	20,000	.0066	0.	
15,000	25,000	.0082	.....	
18,000	30,000	.0100	0.	
21,000	35,000	.0119	0.	
21,600	36,000	.0122	.....	
22,200	37,000	.0126	.....	
22,800	38,000	.0130	.....	
23,400	39,000	.0133	.....	
24,000	40,000	.0138	.0001	
24,600	41,000	.0141	.....	
25,200	42,000	.0147	.....	
25,800	43,000	.0150	.....	Elastic limit.
26,400	44,000	.0159	.....	
27,000	45,000	.0480	.0322	
27,600	46,000	.0570	.....	
28,200	47,000	.0636	.....	
28,800	48,000	.0695	.....	
29,400	49,000	.0772	.....	
30,000	50,000	.0844	.0647	
30,600	51,000	.0911	.....	
31,200	52,000	.0970	.....	
31,800	53,000	.1068	.....	
32,400	54,000	.1160	.....	
33,000	55,000	.1262	.1034	
33,600	56,000	.1328	.....	
34,200	57,000	.1388	.....	
34,800	58,000	.1450	.....	
35,400	59,000	.1588	.....	
36,000	60,000	.1701	.1446	
37,200	62,000	.19	.....	
38,400	64,000	.21	.....	
39,600	66,000	.23	.....	
40,800	68,000	.26	.....	
42,000	70,000	.28	.....	
43,200	72,000	.32	.....	
44,400	74,000	.35	.....	
45,600	76,000	.38	.....	
46,800	78,000	.42	.....	
48,000	80,000	.47	.....	
49,200	82,000	.52	.....	
50,400	84,000	.57	.....	
51,600	86,000	.65	.....	
52,800	88,000	.76	.....	
54,000	90,000	.90	.....	
55,200	92,000	1.14	.....	
55,860	93,100	1.52	.....	Tensile strength.
50,400	.....	.....	.....	At time of rupture.
0	0	1.76	.....	=17.6 per cent.

Elongation of inch sections: ″.13, ″.18, ″.18, ″.39*, ″.21, ″.15, ″.15, ″.13, ″.13, ″.11.
Diameter at fracture, ″.69. Area, .374 square inch.
Contraction of area, 37.7 per cent.
Fractured 4″.4 from the neck. Appearance, granular, silky center.

No. 19

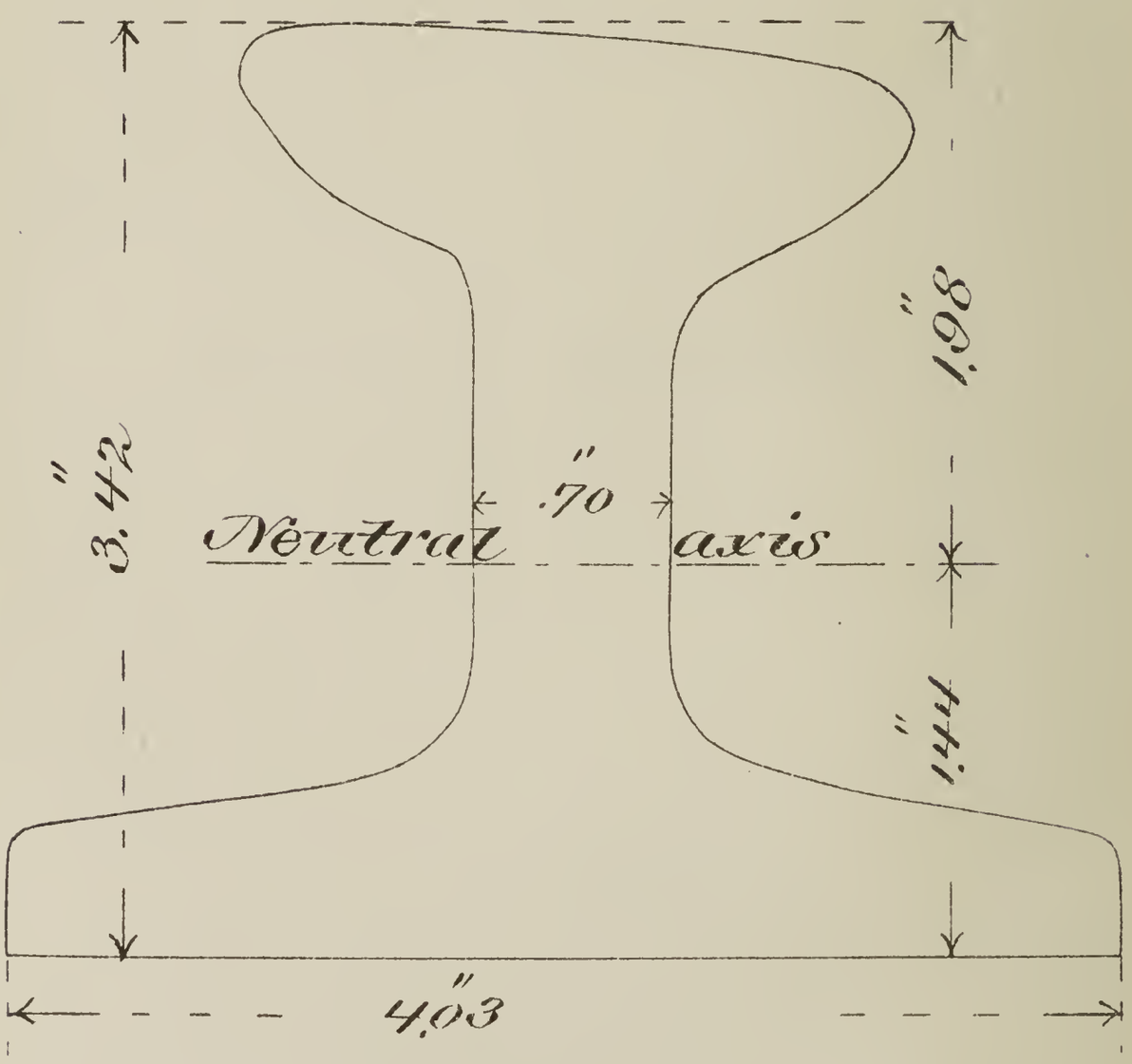
Branded " 6 Sec No. 65 "



H Ex 161 52 1

No. 20.

Branded "Crawshaw B 4"



H Ex 161 52 1

No. 4486.

RAIL NO. 20.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0011	0.	
2,500	10,000	.0021	.....	
3,750	15,000	.0031	.....	
5,000	20,000	.0043	0.	
6,250	25,000	.0057	.0002	
6,500	26,000	.0060	.....	
6,750	27,000	.0062	.....	
7,000	28,000	.0066	.....	
7,250	29,000	.0069	.....	
7,500	30,000	.0073	.0008	
7,750	31,000	.0078	.....	
8,000	32,000	.0082	.....	Elastic limit (not well defined).
8,250	33,000	.0092	.....	
8,500	34,000	.0101	.....	
8,750	35,000	.0110	.....	
9,000	36,000	.0116	.....	
9,250	37,000	.0120	.....	
9,500	38,000	.0126	.....	
9,750	39,060	.0138	.....	
10,000	40,000	.0161	.0070	Rested under initial load 5 minutes.
10,250	41,000	.0178	.....	
10,500	42,000	.0228	.....	
10,750	43,000	.0277	.....	
11,000	44,000	.0342	.....	
11,250	45,000	.0460	.0351	
11,500	46,000	.0517	.0410	
11,500	46,000	.0670	.....	
11,750	47,000	.08	.....	
12,000	48,000	.10	.....	
12,250	49,000	.12	.....	
12,500	50,000	.16	.....	
12,750	51,000	.19	.....	
13,000	52,000	.23	.....	
13,190	52,760	.....	.....	Tensile strength.
0	0	.30	.....	= 3 per cent.

Elongation of inch sections: ″.04, ″.04, ″.03, ″.08*, ″.07*, ″.04.
Diameter at fracture, ″.52. Area, .212 square inch.
Contraction of area, 15.2 per cent.
Fractured 2″.15 from the neck. Appearance, coarse granular 70 per cent, dark spongy 30 per cent. Opened cracks along surface of stem.

No. 4458.

Rail No. 21.

Diameter, ″.714.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0012	0.	
4,000	10,000	.0031	.....	
6,000	15,000	.0050	.....	
8,000	20,000	.0067	.....	
10,000	25,000	.0082	.....	
12 000	30,000	.0102	0.	
12,400	31,000	.0106	.....	
12,800	32,000	.0108	.....	
13,200	33,000	.0115	.....	
13,600	34,000	.0119	.....	
14,000	35,000	.0123	.0007	Elastic limit.
14,400	36,000	.0133	.....	
14,800	37,000	.0141	.....	
15,200	38,000	.0153	.....	
15,600	39,000	.0172	.....	
16,000	40,000	.0210	.0071	
16,400	41,000	.0251	.....	
16,800	42,000	.0290	.....	
17,200	43,000	.0339	.....	
17,600	44,000	.0378	.....	
18,000	45,000	.0428	.....	
18,400	46,000	.0535	.....	
18,800	47,000	.0600	.....	
19,200	48,000	.0703	.....	
19,600	49,000	.0788	.....	
20,000	50,000	.0870	.....	Rested under initial load 15 hours.
20,000	50,000	.0887	.0686	Elongation when load was applied, following rest.
20,400	51,000	.0911	.....	
20,800	52,000	.0958	.....	
21,200	53,000	.1149	.....	
21,600	54,000	.1302	.....	
22,000	55,000	.1387	.....	
22,400	56,000	.1500	.....	
22,800	57,000	.1598	.....	
23,200	58,000	.1740	.....	
23,600	59,000	.1900	.....	
24,000	60,000	.2028	.....	
24,800	62,000	.2302	.....	
25,600	64,000	.2598	.....	
26,400	66,000	.2900	.....	
27,200	68,000	.3295	.....	
28,000	70,000	.38	.....	
28,800	72,000	.42	.....	
29,600	74,000	.47	.....	
30,400	76,000	.53	.....	
31,200	78,000	.62	.....	
32,000	80,000	.72	.....	
32,800	82,000	.83	.....	
33,600	84,000	1.03	.....	
34,220	85,550	1.55	.....	Tensile strength.
29,700	.....	.....	.....	At time of rupture.
0	0	1.87	.....	=18.7 per cent.

Elongation of inch sections: ″.13, ″.18, ″.42*, ″.20, ″.17, ″.15, .″15, ″.16, ″.16, ″.15.

Diameter at fracture, ″.52. Area, .2124 square inch.

Contraction of area, 46.9 per cent.

Fractured 3″.1 from the neck. Appearance, fine silky, cup-shaped, trace of granulation.

No. 4454.

Rail No. 22.

Diameter, ″.714.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0014	0.	
4,000	10,000	.0031	.....	
6,000	15,000	.0050	.....	
8,000	20,000	.0067	.....	
10,000	25,000	.0084	.....	
12,000	30,000	.0100	0.	
12,400	31,000	.0105	.....	
12,800	32,000	.0110	.....	
13,200	33,000	.0112	.....	
13,600	34,000	.0117	.....	
14,000	35,000	.0121	.0001	
14,400	36,000	.0127	.....	
14,800	37,000	.0131	.....	
15,200	38,000	.0137	.....	
15,600	39,000	.0142	.....	Elastic limit.
16,000	40,000	.0151	.0012	
16,400	41,000	.0162	.....	
16,800	42,000	.0177	.....	
17,200	43,000	.0197	.....	
17,600	44,000	.0250	.....	
18,000	45,000	.0335	.0172	
18,400	46,000	.0413	.....	
18,800	47,000	.0480	.....	
19,200	48,000	.0542	.....	
19,600	49,000	.0658	.....	
20,000	50,000	.0740	.....	
20,400	51,000	.0845	.....	
20,800	52,200	.0903	.....	
21,200	53,000	.1012	.....	
21,600	54,000	.1080	.....	
22,000	55,000	.1212	.....	
22,400	56,000	.1280	.....	
22,800	57,000	.1380	.....	
23,200	58,000	.1512	.....	
23,600	59,000	.1605	.....	
24,000	60,000	.1720	.....	
24,800	62,000	.1970	.....	
25,600	64,000	.2200	.....	
26,400	66,000	.2435	.....	
27,200	68,000	.2712	.....	
28,000	70,000	.3010	.....	
28,800	72,000	.34	.....	
29,600	74,000	.39	.....	
30,400	76,000	.42	.....	
31,200	78,000	.47	.....	
32,000	80,000	.52	.....	
32,800	82,000	.58	.....	
33,600	84,000	.67	.....	
34,400	86,000	.77	.....	
35,200	88,000	.90	.....	
36,000	90,000	1.17	.....	
36,240	90,600	1.68	.....	Tensile strength.
32,700	.....	.....	.....	At time of rupture.
0	0	1.83	.....	=18.3 per cent.

Elongation of inch sections: ″.16, ″.20, ″.17, ″.28, ″.32*, ″.17, ″.15, ″.14, ″.12, ″.12.

Diameter at fracture, ″.56. Area, .2463 square inch; contraction of area, 38.4 per cent.

Fractured 5″ from the neck. Appearance, silky, interspersed with fine granular metal at the circumference.

No. 4479.

Rail No. 23.

Diameter, ″.874.
Sectional area, .60 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
600	1,000	0.	0.	Initial load.
3,000	5,000	.0012	.....	
6,000	10,000	.0029	.....	
12,000	20,000	.0064	.....	
18,000	30,000	.0099	.....	
24,000	40,900	.0134	0.	
27,000	45,000	.0153	.0003	
27,600	46,000	.0157	.....	
28,200	47,000	.0160	.....	
28,800	48,000	.0166	.....	
29,400	49,000	.0169	.....	
30,000	50,000	.0174	.0007	
30,600	51,000	.0180	.....	
31,200	52,000	.0185	.....	
31,800	53,000	.0191	.....	Elastic limit.
32,400	54,000	.0205	.....	
33,000	55,000	.0218	.0029	
33,600	56,000	.0242	.....	
34,200	57,000	.0275	.....	
34,800	58,000	.0319	.....	
35,400	59,000	.0370	.....	
36,000	60,000	.0440	.....	
37,200	62,000	.0560	.....	
38,400	64,000	.0688	.....	
39,600	66,000	.0820	.....	
40,800	68,000	.0972	.....	
42,000	70,000	.1116	.....	
43,200	72,000	.1225	.....	
44,400	74,000	.1380	.....	
45,600	76,000	.1517	.....	
46,800	78,000	.1660	.....	
48,000	80,000	.1860	.....	
50,400	84,000	.21	.....	
52,800	88,000	.25	.....	
55,200	92,000	.31	.....	
57,600	96,000	.35	.....	
60,000	100,000	.41	.....	
62,400	104,000	.49	.....	
64,800	108,000	.59	.....	
67,200	112,000	.....	.....	Tensile strength.
0	0	.73	.....	=7.3 per cent.

Elongation of inch sections: ″.06, ″.07, ″.08, ″.07, ″.08, ″.09*, ″.07, ″.08, ″.07, ″.06.
Diameter at fracture, ″.83. Area, .541 square inch.
Contraction of area, 9.8 per cent.
Fractured 5″ from the neck. Appearance, granular.
Fractured under the maximum load.

No. 4480.

RAIL NO. 23.

Diameter, ″.874.
Sectional area, .60 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
600	1,000	0:	0.	Initial load.
3,000	5,000	.0014	.....	
6,000	10,000	.0031	.....	
12,000	20,000	.0064	.....	
18,000	30,000	.0100	.....	
24,000	40,000	.0141	.0006	
24,600	41,000	.0146	.....	
25,200	42,000	.0151	.....	
25,800	43,000	.0159	.....	
26,400	44,000	.0164	.....	Elastic limit (approximate.)
27,000	45,000	.0171	.0018	
27,600	46,000	.0180	.....	
28,200	47,000	.0188	.....	
28,800	48,000	.0197	.....	
29,400	49,000	.0207	.....	
30,000	50,000	.0217	.0046	
30,600	51,000	.0230	.....	
31,200	52,000	.0241	.....	
31,800	53,000	.0254	.....	
32,400	54,000	.0270	.....	
33,000	55,000	.0291	.0100	
33,600	56,000	.0330	.....	
34,200	57,000	.0368	.....	
34,800	58,000	.0401	.....	
35,400	59,000	.0457	.....	
36,000	60,000	.0508	.....	
37,200	62,000	.0620	.....	
38,400	64,000	.0758	.....	
39,600	66,000	.0895	.....	
40,800	68,000	.1020	.....	
42,000	70,000	.1157	.....	
43,200	72,000	.1288	.....	
44,400	74,000	.1445	.....	
45,600	76,000	.1600	.....	
46,800	78,000	.1761	.....	
48,000	80,000	.1945	.....	
50,400	84,000	.21	.....	
52,800	88,000	.28	.....	
55,200	92,000	.33	.....	
57,600	96,000	.39	.....	
60,000	100,000	.44	.....	
62,400	104,000	.54	.....	
64,800	108,000	.66	.....	
67,200	112,000	1.02	.....	
67,280	112,130	.....	.....	Tensile strength.
61,800	.....	.....	.....	At time of rupture.
0	0	1.26	.....	=12.6 per cent.

Elongation of inch sections: ″.07, ″.11, ″.11, ″.13, ″.27*, ″.19, ″.10, ″.09, ″.11, ″.08.

Diameter at fracture, ″.73. Area, .419 square inch.

Contraction of area, 30.2 per cent.

Fractured 5″.4 from the neck. Appearance, granular; small, dull, silky spot at the circumference.

No. 4455.

Rail No. 24.

Diameter, ″.714.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.6013	0.	
4,000	10,000	.0031	.....	
6,000	15,000	.0050	.....	
8,000	20,000	.0067	.....	
10,000	25,000	.0085	.....	
12,000	30,000	.0101	0.	
12,400	31,000	.0106	.....	
12,800	32,000	.0110	.....	
13,200	33,000	.0112	.....	
13,600	34,000	.0117	.....	
14,000	35,000	.0120	0.	
14,400	36,000	.0123	.....	
14,800	37,000	.0127	.....	
15,200	38,000	.0130	.....	
15,600	39,000	.0134	.....	
16,000	40,000	.0138	0.	
16,400	41,000	.0141	.....	
16,800	42,000	.0146	.....	
17,200	43,000	.0150	.....	
17,600	44,000	.0152	.....	
18,000	45,000	.0158	.0001	
18,400	46,000	.0161	.....	
18,800	47,000	.0166	.....	
19,200	48,000	.0170	.....	
19,600	49,000	.0173	.....	Elastic limit.
20,000	50,000	.0181	.0010	
20,400	51,000	.0213	.....	
20,800	52,000	.0428	.....	
21,200	53,000	.0730	.....	
21,600	54,000	.0820	.....	
22,000	55,000	.0958	.....	
22,400	56,000	.1055	.....	
22,800	57,000	.1172	.....	
23,200	58,000	.1251	.....	
23,600	59,000	.1420	.....	
24,000	60,000	.1555	.....	
24,800	62,000	.1870	.....	
25,600	64,000	.2180	.....	
26,400	66,000	.2510	.....	
27,200	68,000	.2870	.....	
28,000	70,000	.3330	.....	
28,800	72,000	.38	.....	
29,600	74,000	.42	.....	
30,400	76,000	.49	.....	
31,200	78,000	.57	.....	
32,000	80,000	.67	.....	
32,800	82,000	.79	.....	
33,600	84,000	.90	.....	
34,400	86,000	1.23	.....	
34,680	86,700	1.81	.....	Tensile strength.
28,500	.....	.....	.....	At time of rupture.
0	0	2.02	.....	=20.2 per cent.

Elongation of inch sections: ″.13, ″.15, ″.16, ″.16, ″.18, ″.19, ″.46,* ″.24, ″.21, ″.14.

Diameter at fracture, ″.50. Area, .1964 square inch.

Contraction of area, 50.9 per cent.

Fractured 4″.25 from the neck. Appearance, fine silky, interspersed with fine granulation at the circumference.

No. 4464.

Rail No. 24.

Diameter, ″.714.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0014	0.	
4,000	10,000	.0032	.....	
6,000	15,000	.0047	.....	
8,000	20,000	.0065	.....	
10,000	25,000	.0082	.....	
12,000	30,000	.0099	0.	
14,000	35,000	.0117	.....	
16,000	40,000	.0136	0.	
16,400	41,000	.0138	.....	
16,800	42,000	.0140	.....	
17,200	43,000	.0143	.....	
17,600	44,000	.0147	.....	
18,000	45,000	.0151	0.	
18,400	46,000	.0155	.....	
18,800	47,000	.0160	.....	
19,200	48,000	.0163	.....	
19,600	49,000	.0168	.....	
20,000	50,000	.0172	.0003	Elastic limit.
20,400	51,000	.0180	.....	
20,800	52,000	.0240	.....	
21,200	53,000	.0510	.....	
21,600	54,000	.0670	.....	
22,000	55,000	.0759	.0562	
22,400	56,000	.0840	.....	
22,800	57,000	.0980	.....	
23,200	58,000	.1120	.....	
23,600	59,000	.1345	.....	
24,000	60,000	.1492	.1270	
24,800	62,000	.18	.....	
25,600	64,000	.205	.....	
26,400	66,000	.24	.....	
27,200	68,000	.28	.....	
28,000	70,000	.32	.....	
28,800	72,000	.37	.....	
29,600	74,000	.42	.....	
30,400	76,000	.48	.....	
31,200	78,000	.55	.....	
32,000	80,000	.65	.....	
32,800	82,000	.75	.....	
33,600	84,000	.90	.....	
34,400	86,000	1.22	.....	
34,610	86,525	1.56	.....	Tensile strength.
28,100	.....	.....	.....	At time of rupture.
0	0	1.87	.....	=18.7 per cent.

Elongation of inch sections: ″.12, ″.16, ″.17, ″.15, ″.12, ″.18, ″.47*, ″.20, ″.17, ″.13.

Diameter at fracture, ″.50. Area, .196 square inch.

Contraction of area, 51 per cent.

Fractured 4″.1 from the neck. Appearance, silky, interspersed with fine granulation.

No. 4460.

Rail No. 25.

Diameter, ″.713.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0015	0.	
4.000	10,000	.0034	.....	
6,000	15,000	.0050	.....	
8,000	20,000	.0067	.....	
10,000	25,000	.0082	.....	
12,000	30,000	.0101	0.	
14.000	35,000	.0118	.....	
16,000	40,000	.0140	.0007	Elastic limit.
16,400	41,000	.0190	.....	
16,800	42,000	.0636	.....	
17,200	43,000	.0720	.....	
17,600	44,000	.0853	.....	
18,000	45,000	.0972	.0802	
18,400	46,000	.1050	.....	
18,800	47,000	.1198	.....	
19,200	48.000	.1306	.....	
19,600	49,000	.1482	.....	
20,000	50,000	.1658	.1460	
20,800	52,000	.20	.....	
21,600	54,000	.23	.....	
22,400	56,000	.27	.....	
23,200	58,000	.32	.....	
24,000	60,000	.37	.....	
24,800	62,000	.42	.....	
25,600	64,000	.48	.....	
26,400	66,000	.57	.....	
27,200	68,000	.65	.....	
28.000	70,000	.78	.....	
28,800	72,000	1.01	.....	
29,600	74,000	1.56	.....	
29,700	74,250	1.90	.....	Tensile strength.
24,100	.....	.....	.....	At time of fracture.
0	0	2.05	.....	= 20.5 per cent.

Elongation of inch sections: ″.13, ″.17, ″.18, ″.18, ″.18, ″.44*, ″.25, ″.23, ″.16, ″.13.

Diameter at fracture, ″.51. Area, .204 square inch.

Contraction of area, 49 per cent.

Fractured 5″ from the neck. Appearance, silky, interspersed with fine granulation.

No. 4461.

Rail No. 26.

Diameter, ″.714.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0012	0.	
4,000	10,000	.0030	.....	
6,000	15,000	.0048	.....	
8,000	20,000	.0065	.....	
10,000	25,000	.0082	.....	
12,000	30,000	.0100	0.	
12,400	31,000	.0104	.....	
12,800	32,000	.0108	.....	
13,200	33,000	.0113	.....	
13,600	34,000	.0119	.....	
14,000	35,000	.0126	.0008	
14,400	36,000	.0131	.....	
14,800	37,000	.0138	.....	
15,200	38,000	.0143	.....	
15,600	39,000	.0150	.....	Elastic limit. (Approximate.)
16,000	40,000	.0293	.0158	
16,400	41,000	.0695	.....	
16,800	42,000	.1580	.....	
17,200	43,000	.1671	.....	
17,600	44,000	.1795	.....	
18,000	45,000	.1990	.1808	
18,400	46,000	.2068	.....	
18,800	47,000	.2250	.....	
19,200	48,000	.2450	.....	
19,600	49,000	.2690	.....	
20,000	50,000	.3020	.2810	
20,800	52,000	.35	.....	
21,600	54,000	.42	.....	
22,400	56,000	.49	.....	
23,200	58,000	.58	.....	
24,000	60,000	.70	.....	
24,800	62,000	.87	.....	
25,600	64,000	1.13	.....	
26,240	65,600	1.90	.....	Tensile strength.
20,300	.....	.....	.....	At time of rupture.
0	0	2.37	.....	=23.7 per cent.

Elongation of inch sections: ″.32, ″.43*, ″.24, ″.21, ″.21, ″.22, ″.24, ″.20, ″.17, ″.13.
Diameter at fracture, ″.47. Area, .173 square inch.
Contraction of area, 56.7 per cent.
Fractured 1′4.3 from the neck. Appearance, silky.

No. 4462.

Rail No. 27.

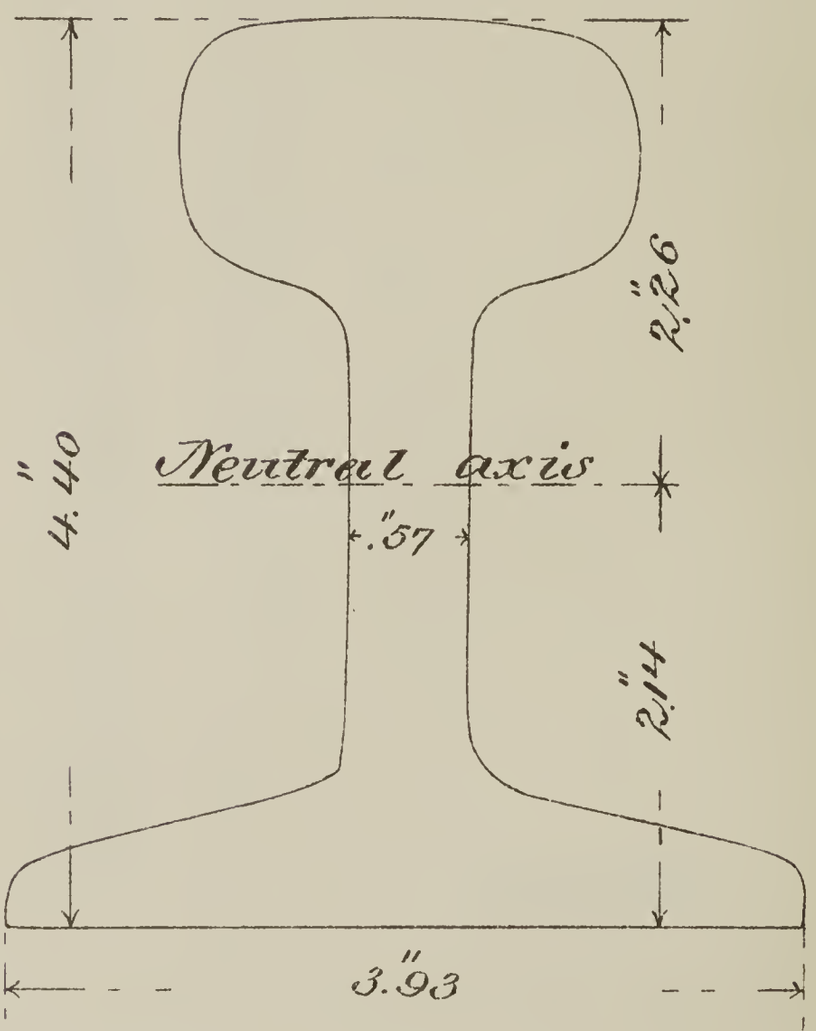
Diameter, ″.713.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0014	0.	
4,000	10,000	.0032	.....	
6,000	15,000	.0050	.....	
8,000	20,000	.0068	.....	
10,000	25,000	.0085	.....	
12,000	30,000	.0102	0.	
12,400	31,000	.0106	.....	
12,800	32,000	.0110	.....	
13,200	33,000	.0113	.....	
13,600	34,000	.0117	.....	
14,000	35,000	.0122	.0001	
14,400	36,000	.0127	.....	
14,800	37,000	.0130	.....	Elastic limit.
15,200	38,000	.0139	.....	
15,600	39,000	.0181	.....	
16,000	40,000	.0200	.0060	
16,400	41,000	.0212	.....	
16,800	42,000	.0230	.....	
17,200	43,000	.0320	.....	
17,600	44,000	.0376	.....	
18,000	45,000	.0480	.0324	
18,400	46,000	.0562	.....	
18,800	47,000	.0630	.....	
19,200	48,000	.0728	.....	
19,600	49,000	.0832	.....	
20,000	50,000	.0940	.0753	
20,400	51,000	.1020	.....	
20,800	52,000	.1146	.....	
21,200	53,000	.1260	.....	
21,600	54,000	.1402	.....	
22,000	55,000	.1548	.1332	
22,400	56,000	.1620	.....	
22,800	57,000	.1690	.....	
23,200	58,000	.1815	.....	
23,600	59,000	.2175	.....	
24,000	60,000	.2378	.2135	
24,800	62,000	.27	.....	
25,600	64,000	.32	.....	
26,400	66,000	.37	.....	
27,200	68,000	.43	.....	
28,000	70,000	.49	.....	
28,800	72,000	.58	.....	
29,600	74,000	.68	.....	
30,400	76,000	.87	.....	
30,990	77,475	1.20	.....	Tensile strength.
25,200	.....	.....	.....	At time of rupture.
0	0	1.45	.....	= 14.5 per cent.

Elongation of inch sections: ″.10, ″.20, ″.47*, ″.14, ″.09, ″.07, ″.12, ″.09, ″.10, ″.07.
Diameter at fracture, ″.49. Area, .1885 square inch.
Contraction of area, 52.9 per cent.
Fractured 2″.75 from the neck. Appearance, silky.

No. 28

Branded "Barrow Steel 1873 :::: 55"



No. 4481.

Rail No. 28.

Diameter, ″.874.
Sectional area, .60 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
600	1,000	0.	0.	Initial load.
3,000	5,000	.0013	.....	
6,000	10,000	.0031	.....	
12,000	20,000	.0065	.....	
18,000	30,000	.0100	0.	
21,000	35,000	.0117	.....	
21,600	36,000	.0121	.....	
22,200	37,000	.0125	.....	
22,800	38,000	.0129	.....	
23,400	39,000	.0133	.....	Elastic limit.
24,000	40,000	.0140	.0008	
24,600	41,000	.0149	.....	
25,200	42,000	.0308	.....	
25,800	43,000	.0637	.....	
26,400	44,000	.0735	.....	
27,000	45,000	.0907	.0740	
27,600	46,000	.1030	.....	
28,200	47,000	.1160	.....	
28,800	48,000	.1330	.....	
29,400	49,000	.1510	.....	
30,000	50,000	.1665	.....	
30,600	51,000	.1860	.....	
31,200	52,000	.2050	.....	
31,800	53,000	.2275	.....	
32,400	54,000	.2500	.....	
33,000	55,000	.27	.....	
33,600	56,000	.30	.....	
34,200	57,000	.34	.....	
34,800	58,000	.37	.....	
35,400	59,000	.40	.....	
36,000	60,000	.45	.....	
36,600	61,000	.49	.....	
37,200	62,000	.54	.....	
37,800	63,000	.60	.....	
38,400	64,000	.67	.....	
39,000	65,000	.77	.....	
39,600	66,000	.87	.....	
40,200	67,000	1.03	.....	
40,800	68,000	1.38	.....	
40,820	68,030	.....	.....	Tensile strength.
30,700	.....	.....	.....	At time of fracture.
0	0	2.08	.....	=20.8 per cent.

Elongation of inch sections: ″.10, ″.13, ″.10, ″.09, ″.16, ″.35, ″.54*, ″.26, ″.21, ″.14.
Diameter at fracture, ″.57. Area, .255 square inch.
Contraction of area, 57.5 per cent.
Fractured 5″ from the neck. Appearance, fine silky.

No. 4456.

RAIL No. 29.

Diameter, ″.714.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		Elongation.	Set.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0013	.....	
4,000	10,000	.0031	.....	
6,000	15,000	.0050	.....	
8,000	20,000	.0067	.....	
10,000	25,000	.0086	.....	
11,600	29,000	.0099	.....	Elastic limit.
12,000	30,000	.0111	.0008	
12,400	31,000	.0120	.....	
12,800	32,000	.0130	.....	
13,200	33,000	.0157	.....	
13,600	34,000	.0270	.....	
14,000	35,000	.0362	.0230	
14,400	36,000	.0430	.....	
14,800	37,000	.0498	.....	
15,200	38,000	.0560	.....	
15,600	39,000	.0648	.....	
16,000	40,000	.0738	.0573	
16,400	41,000	.0790	.....	
16,800	42,000	.0890	.....	
17,200	43,000	.0960	.....	
17,600	44,000	.1060	.....	
18,000	45,000	.1158	.....	
18,400	46,000	.1241	.....	
18,800	47,000	.1350	.....	
19,200	48,000	.1430	.....	
19,600	49,000	.1557	.....	
20,000	50,000	.1640	.....	
20,400	51,000	.1790	.....	
20,800	52,000	.1885	.....	
21,200	53,000	.2015	.....	
21,600	54,000	.2140	.....	
22,000	55,000	.2290	.....	
22,400	56,000	.2430	.....	
22,800	57,000	.2580	.....	
23,200	58,000	.2760	.....	
23,600	59,000	.2930	.....	
24,000	60,000	.3090	.....	
24,800	62,000	.3480	.....	
25,600	64,000	.40	.....	
26,400	66,000	.46	.....	
27,200	68,000	.53	.....	
28,000	70,000	.61	.....	
28,800	72,000	.73	.....	
29,600	74,000	.95	.....	
30,280	75,700	1.40	.....	Tensile strength.
0	0	1.40	.....	=14 per cent.

Elongation of inch sections: ″.08, ″.12, ″.11, ″.11, ″.12, ″.13, ″.14, ″.17, ″.24*, ″.18.

Diameter at fracture, ″.62. Area, .3019 square inch.

Contraction of area, 24.5 per cent.

Fractured 1″.3 from the neck. Appearance, granular; silky spot at the circumference where the metal separated first.

No. 4557.

Rail No. 29.

Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 20″.
Length of stem, 24″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0027	0.	
10,000	10,000	.0062	.....	
15,000	15,000	.0098	.....	
20,000	20,000	.0132	0.	
25,000	25,000	.0168	.0001	
26,000	26,000	.0177	.....	
27,000	27,000	.0183	.....	
28,000	28,000	.0192	.....	
29,000	29,000	.0200	.....	
30,000	30,000	.0209	.0007	
31,000	31,000	.0219	.....	Elastic limit (not well defined).
32,000	32,000	.0231	.....	
33,000	33,000	.0243	.....	
34,000	34,000	.0267	.....	
35,000	35,000	.0292	.0057	
36,000	36,000	.0345	.....	
37,000	37,000	.0372	.....	
38,000	38,000	.0450	.....	
39,000	39,000	.0507	.....	
40,000	40,000	.0588	.0313	
42,000	42,000	.07	.....	
44,000	44,000	.09	.....	
46,000	46,000	.11	.....	
48,000	48,000	.14	.....	
50,000	50,000	.16	.....	
52,000	52,000	.20	.....	
54,000	54,000	.23	.....	
56,000	56,000	.28	.....	
58,000	58,000	.34	.....	
60,000	60,000	.40	.....	
62,000	62,000	.47	.....	
64,000	64,000	.54	.....	
66,000	66,000	.65	.....	
68,000	68,000	.77	.....	
70,000	70,000	.96	.....	
72,000	72,000	1.19	.....	
74,000	74,000	1.52	.....	Tensile sternath.
73,300	.....	.....	.....	At time of fracture.
0	0	1.43	.....	=7.2 per cent.

Elongation of inch sections: ″.11*, ″.09, ″.08, ″.08, ″.07, ″.09, ″.07, ″.08, ″.07, ″.07, ″.06, ″.05, ″.05, ″.04, ″.06, ″.07, ″.07, ″.08, ″.08, ″.08, ″.09, ″.09, ″.08, ″.09.

Diameter at fracture, 1″.07 Area, ″.899 square inch.

Contraction of area, 10.1 per cent.

Fractured 1″ from neck. Appearance, granular, radiating from a dull spot at the circumference.

No. 4457.

Rail No. 30.

Diameter, ″.714.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0013	0.	
4,000	10,000	.0031	.....	
6,000	15,000	.0050	.....	
8,000	20,000	.0068	.....	
10,000	25,000	.0087	0.	
12,000	30,000	.0106	0.	
12,400	31,000	.0110	.....	
12,800	32,000	.0112	.....	
13,200	33,000	.0116	.....	
13,600	34,000	.0120	.....	
14,000	35,000	.0124	0.	
14,400	36,000	.0130	.....	
14,800	37,000	.0133	.....	
15,200	38,000	.0140	.....	
15,600	39,000	.0145	.....	Elastic limit.
16,000	40,000	.0155	.0011	
16,400	41,000	.0182	.....	
16,800	42,000	.0280	.....	
17,200	43,000	.0374	.....	
17,600	44,000	.0480	.....	
18,000	45,000	.0602	.0425	
18,400	46,000	.0667	.....	
18,800	47,000	.0768	.....	
19,200	48,000	.0869	.....	
19,600	49,000	.0942	.....	
20,000	50,000	.1040	.....	
20,400	51,000	.1140	.....	
20,800	52,000	.1267	.....	
21,200	53,000	.1361	.....	
21,600	54,000	.1440	.....	
22,000	55,000	.1620	.....	
22,400	56,000	.1690	.....	
22,800	57,000	.1820	.....	
23,200	58,000	.1965	.....	
23,600	59,000	.2125	.....	
24,000	60,000	.2310	.....	
24,800	62,000	.28	.....	Crack opened in stem.
25,600	64,000	.31	.....	
26,400	66,000	.....	.....	Tensile strength.
0	0	.29	.....	=2.9 per cent.

Elongation of inch sections: ″.02, ″.02, ″.03, ″.03, ″.03, ″.05*, ″.03 ″.03, ″.03, ″.02.

Diameter at fracture, ″.69. Area, .3739 square inch.

Contraction of area, 6.5 per cent.

Fractured 4″.9 from the neck. Appearance, granular, dull silky spot at the circumference. A series of fine transverse cracks were opened along one side of the stem, at intervals of about $\frac{1}{4}$ inch, continuing for one-half the length of the stem. The silky spot was at one of these cracks.

No. 4465.

Rail No. 30.

Diameter, ″.713.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0012	.....	
4,000	10,000	.0032	.....	
6,000	15,000	.0050	.....	
8,000	20,000	.0067	.....	
10,000	25,000	.0083	.....	
12,000	30,000	.0101	0.	
12,400	31,000	.0105	.....	
12,800	32,000	.0108	.....	
13,200	33,000	.0112	.....	
13,600	34,000	.0117	.....	
14,000	35,000	.0120	0.	
14,400	36,000	.0123	.....	
14,800	37,000	.0128	.....	
15,200	38,000	.0132	.....	
15,600	39,000	.0137	.....	
16,000	40,000	.0142	.0008	Elastic limit.
16,400	41,000	.0152	.....	
16,800	42,000	.0178	.....	
17,200	43,000	.0257	.....	
17,600	44,000	.0342	.....	
18,000	45,000	.0418	.0255	
18,400	46,000	.0490	.....	
18,800	47,000	.0578	.....	
19,200	48,000	.0668	.....	
19,600	49,000	.0762	.....	
20,000	50,000	.0870	.0677	
20,400	51,000	.0947	.....	
20,800	52,000	.1018	.....	
21,200	53,000	.1144	.....	
21,600	54,000	.1268	.....	
22,000	55,000	.1380	.1162	
22,400	56,000	.1460	.....	
22,800	57,000	.1585	.....	
23,200	58,000	.1730	.....	
23,600	59,000	.1815	.....	
24,000	60,000	.1960	.1715	
24,800	62,000	.23	.....	
25,600	64,000	.27	.....	
26,400	66,000	.30	.....	
27,200	68,000	.34	.....	
28,000	70,000	.....	.....	Tensile strength.
0	0	.33	.....	=3.3 per cent.

Elongation of inch sections: ″.03*, ″.04, ″.02, ″.04, ″.03, ″.04, ″.02, ″.05, ″.03, ″.03.

Diameter at fracture, ″.69. Area, .374 square inch.

Contraction of area, 6.5 per cent.

Fractured ″.8 from the neck. Appearance, granular, radiating from a dull spot in the circumference; this dull spot is in line with a series of fine transverse cracks along one side of the stem.

A snapping sound was heard a few seconds preceding rupture.

No. 4482.

Rail No. 31.

Diameter, ″.874.
Sectional area, .60 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
600	1,000	0.	0.	Initial load.
3,000	5,000	.0014	.....	
6,000	10,000	.0031	.....	
12,000	20,000	.0067	.....	
18,000	30,000	.0101	0.	
21,000	35,000	.0120	.....	
21,600	36,000	.0125	.....	
22,200	37,000	.0130	.....	
22,800	38,000	.0134	.....	
23,400	39,000	.0140	.....	Elastic limit.
24,000	40,000	.0150	.0018	
24,600	41,000	.0239	.....	
25,200	42,000	.0369	.....	
25,800	43,000	.0450	.....	
26,400	44,000	.0504	.....	
27,000	45,000	.0567	.0400	
27,600	46,000	.0628	.....	
28,200	47,000	.0701	.....	
28,800	48,000	.0798	.....	
29,400	49,000	.0853	.....	
30,000	50,000	.0940	.....	
30,600	51,000	.1018	.....	
31,200	52,000	.1120	.....	
31,800	53,000	.1200	.....	
32,400	54,000	.1310	.....	
33,000	55,000	.1410	.....	
33,600	56,000	.1510	.....	
34,200	57,000	.1620	.....	
34,800	58,000	.1725	.....	
35,400	59,000	.1850	.....	
36,000	60,000	.1958	.....	
36,600	61,000	.21	.....	
37,200	62,000	.22	.....	
37,800	63,000	.235	.....	
38,400	64,000	.25	.....	
39,000	65,000	.265	.....	
39,600	66,000	.28	.....	
40,200	67,000	.30	.....	
40,800	68,000	.31	.....	
41,400	69,000	.33	.....	
42,000	70,000	.35	.....	
43,200	72,000	.40	.....	
44,400	74,000	.45	.....	
45,600	76,000	.52	.....	
46,800	78,000	.60	.....	
48,000	80,000	.70	.....	
49,200	82,000	.80	.....	
50,400	84,000	1.05	.....	
51,130	85,220	1.40	.....	Tensile strength.
45,300	.....	.....	.....	At time of rupture.
0	0	1.59	.....	=15.9 per cent.

Elongation of inch sections: ″.11, ″.14, ″.15, ″.17, ″.30*, ″.30*, ″.14, ″.11, ″.09, ″.08.

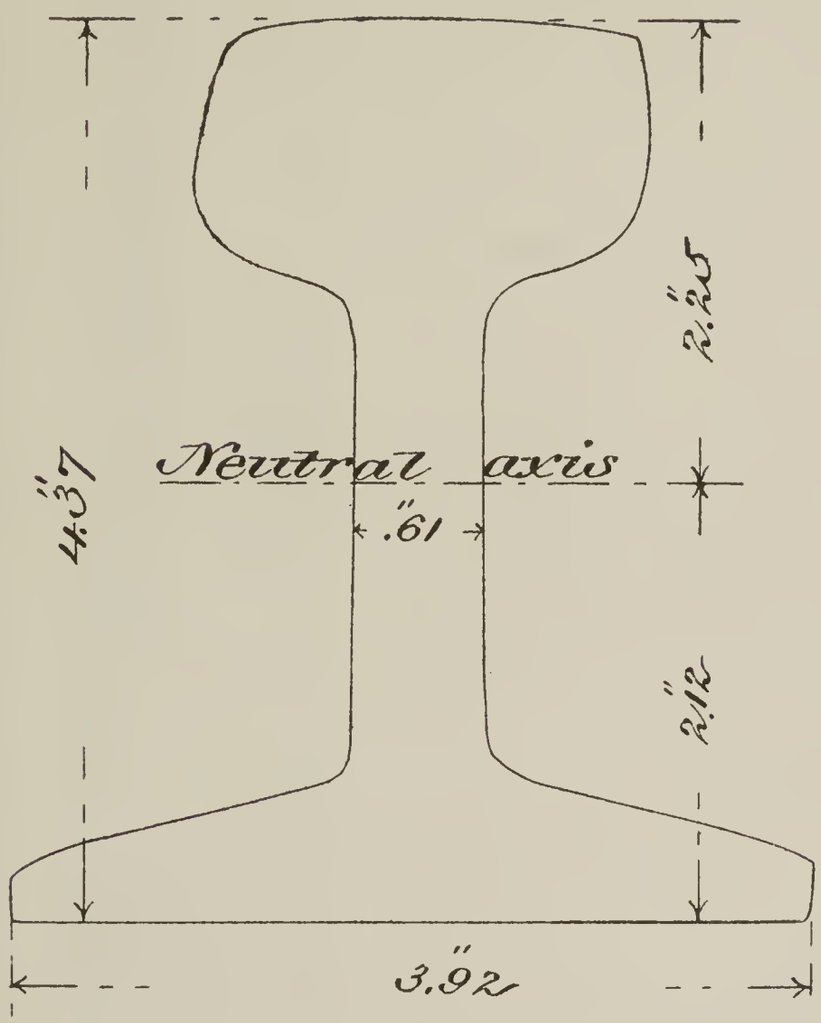
Diameter at fracture, ″.67. Area, .353 square inch.

Contraction of area, 41.2 per cent.

Fractured at middle of stem. Appearance, silky, interspersed with fine granulation at circumference.

No. 31.

Branded "Dowtais Steel 7 70 Guaranteed"



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No. 4463.

Rail No. 32.

Diameter, ″.714.
Sectional area, .40 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	.0	0.	Initial load.
2,000	5,000	.0013	0.	
4,000	10,000	.0029	.....	
6,000	15,000	.0046	.....	
8,000	20,000	.0063	0.	
10,000	25,000	.0080	.....	
12,000	30,000	.0097	0.	
14,000	35,000	.0114	0.	
16,000	40,000	.0132	.0001	
16,400	41,000	.0136	.....	
16,800	42,000	.0140	.....	
17,200	43,000	.0143	.....	
17,600	44,000	.0149	.....	
18,000	45,000	.0152	.0001	
18,400	46,000	.0156	.....	
18,800	47,000	.0160	.....	
19,200	48,000	.0164	.....	
19,600	49,000	.0168	.....	
20,000	50,000	.0173	.0004	
20,400	51,000	.0178	.....	
20,800	52,000	.0184	.....	Elastic limit (not well defined)
21,200	53,000	.0192	.....	
21,600	54,000	.0199	.....	
22,000	55,000	.0211	.0023	
22,400	56,000	.0387	.....	
22,800	57,000	.0490	.....	
23,200	58,000	.0557	.....	
23,600	59,000	.0630	.....	
24,000	60,000	.0702	.0470	
24,800	62,000	.0807	.....	
25,600	64,000	.0958	.....	
26,400	66,000	.1090	.....	
27,200	68,000	.1248	.....	
28,000	70,000	.1397	.1101	
28,800	72,000	.1510	.....	
29,600	74,000	.1688	.....	
30,400	76,000	.1860	.....	
31,200	78,000	.20	.....	
32,000	80,000	.23	.....	
32,800	82,000	.25	.....	
33,600	84,000	.27	.....	
34,400	86,000	.30	.....	
35,200	88,000	.32	.....	
36,000	90,000	.34	.....	
36,800	92,000	.37	.....	
37,600	94,000	.39	.....	
38,400	96,000	.43	.....	
39,200	98,000	.46	.....	
40,000	100,000	.52	.....	
40,800	102,000	.56	.....	
41,600	104,000	.63	.....	
42,400	106,000	.72	.....	
43,200	108,000	.85	.....	
44,000	110,000	1.18	.....	Tensile strength.
39,700	.....	.....	.....	At time of fracture.
0	0	1.41	.....	= 14.1 per cent.

Elongation of inch sections: ″.09, ″.11, ″.12, ″.12, ″.14, ″.12, ″.13, ″.14, ″.31*, ″.13.

Diameter at fracture, ″.58. Area, .264 square inch.

Contraction of area, 34 per cent.

Fractured 1″.65 from the neck. Appearance, fine granular, dull silky center.

No. 4558.

Rail No. 32.

Diameter, 1″.128.
Sectional area, 1 square inch.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0030	0.	
10,000	10,000	.0063	.....	
15,000	15,000	.0098	.....	
20,000	20,000	.0133	.....	
25,000	25,000	.0167	0.	
30,000	30,000	.0199	0.	
35,000	35,000	.0236	.....	
40,000	40,000	.0269	.....	
45,000	45,000	.0305	0.	
46,000	46,000	.0309	.....	
47,000	47,000	.0317	.....	
48,000	48,000	.0326	.....	
49,000	49,000	.0333	.....	
50,000	50,000	.0339	0.	
51,000	51,000	.0347	.....	Elastic limit (approximate).
52,000	52,000	.0356	.....	
53,000	53,000	.0366	.....	
54,000	54,000	.0376	.....	
55,000	55,000	.0390	.0013	
56,000	56,000	.0410	.....	
57,000	57,000	.0450	.....	
58,000	58,000	.0600	.....	
59,000	59,000	.0770	.....	
60,000	60,000	.0870	.0435	
62,000	62,000	.10	.....	
64,000	64,000	.12	.....	
66,000	66,000	.14	.....	
68,000	68,000	.16	.....	
70,000	70,000	.19	.....	
74,000	74,000	.24	.....	
78,000	78,000	.32	.....	
82,000	82,000	.40	.....	
86,000	86,000	.47	.....	
90,000	90,000	.56	.....	
94,000	94,000	.67	.....	
98,000	98,000	.78	.....	
102,000	102,000	.97	.....	
106,000	106,000	1.22	.....	
110,000	110,000	1.68	.....	
110,850	110,850	.....	.....	Tensile strength.
101,000	.....	.....	.....	At time of fracture.
0	0	2.19	.....	=11 per cent.

Elongation of inch sections: ″.07, ″.09, ″.07, ″.10, ″.09, ″.10, ″.09, ″.07, ″.08, ″.07, ″.06, ″.05, ″.07, ″.07, ″.08, ″.11, ″.11, ″.12, ″.13, ″.15, ″.25, ″.32*, ″.15, ″.11.

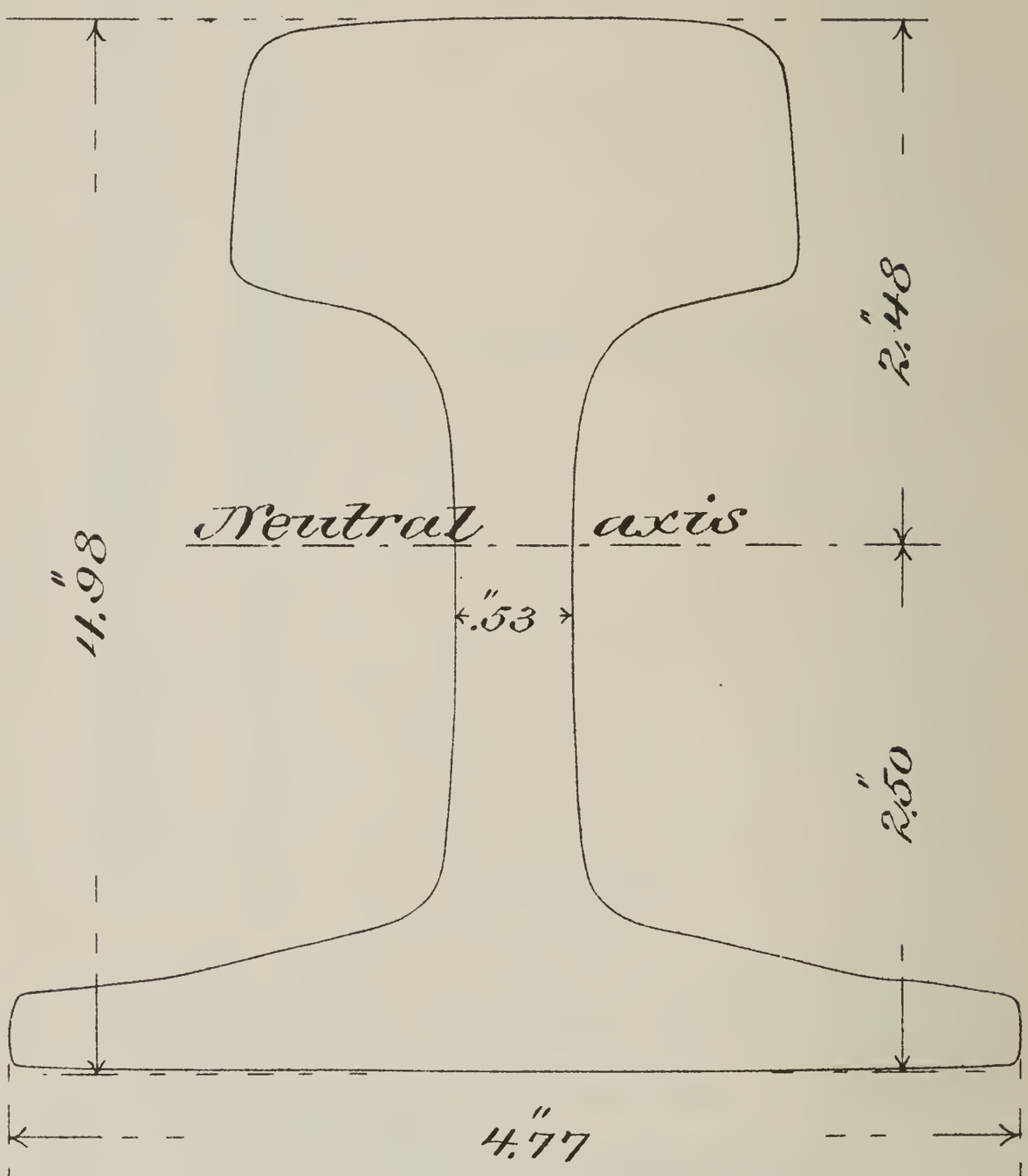
Diameter at fracture, ″.93. Area, .679 square inch.

Contraction of area, 32 per cent.

Fractured 4″ from neck. Appearance, granular, radiating from an eccentric dull spot.

No. 33

Branded "Scranton Steel Co 3 89"



No. 4467.

RAIL NO. 33.

Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
10,000	10,000	.0030	----------	
20,000	20,000	.0064	----------	
30,000	30,000	.0098	0.	
35,000	35,000	.0115	0.	
40,000	40,000	.0133	----------	
45,000	45,000	.0150	----------	
50,000	50,000	.0168	----------	
51,000	51,000	.0171	----------	
52,000	52,000	.0176	----------	
53,000	53,000	.0180	----------	
54,000	54,000	.0183	----------	
55,000	55,000	.0188	.0002	
56,000	56,000	.0192	----------	
57,000	57,000	.0197	----------	
58,000	58,000	.0201	----------	Elastic limit.
59,000	59,000	.0210	----------	
60,000	60,000	.0218	.0012	
61,000	61,000	.0231	----------	
62,000	62,000	.0255	----------	
64,000	64,000	.0341	----------	
66,000	66,000	.0448	----------	
68,000	68,000	.0555	----------	
70,000	70,000	.0680	----------	
72,000	72,000	.0800	----------	
74,000	74,000	.0922	----------	
76,000	76,000	.1050	----------	
78,000	78,000	.1165	----------	
80,000	80,000	.1328	----------	
84,000	84,000	.16	----------	
88,000	88,000	.20	----------	
92,000	92,000	.23	----------	
96,000	96,000	.27	----------	
100,000	100,000	.31	----------	
104,000	104,000	.36	----------	
108,000	108,000	.41	----------	
112,000	112,000	.48	----------	
116,000	116,000	.60	----------	
120,000	120,000	.82	----------	
120,580	120,580	----------	----------	Tensile strength.
0	0	.76	----------	=7.6 per cent.

Elongation of inch sections: ″.06, ″.07, ″.08, ″.08, ″.09, ″.07, ″.08, ″.08, ″.08, ″.08, ″.07.

Fractured at root of thread in head, the diameter of which was 1″.35. Appearance, granular.

No. 4468.

RAIL NO. 33.

Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
800	1,000	0.	0.	
4,000	5.000	.0013	.....	
8,000	10,000	.0030	.....	
16,000	20,000	.0065	.....	
24,000	30,000	.0101	.....	
32,000	40,000	.0132	0.	
36,000	45,000	.0150	.....	
40,000	50,000	.0167	0.	
40,800	51,000	.0170	.....	
41,600	52,000	.0173	.....	
42,400	53,000	.0177	.....	
43,200	54,000	.0181	.....	
44,000	55,000	.0186	0.	
44,800	56,000	.0189	.....	
45,600	57,000	.0195	.....	
46,400	58,000	.0200	.....	
47,200	59,000	.0207	.....	
48,000	60,000	.0212	.0008	Elastic limit.
48.000	60,000	.0220	.....	
48,800	61,000	.0230	.....	
49,600	62,000	.0254	.....	
50,400	63,000	.0300	.....	
51,200	64,000	.0350	.....	
52,800	66,000	.0440	.....	
54,400	68,000	.0560	.....	
56,000	70,000	.0691	.....	
57,600	72,000	.0822	.....	
59,200	74,000	.0960	.....	
60,800	76,000	.1055	.....	
62,400	78,000	.1190	.....	
64,000	80,000	.1320	.....	
67,200	84,000	.17	.....	
70,400	88,000	.20	.....	
73,600	92,000	.23	.....	
76,800	96,000	.27	.....	
80,000	100,000	.31	.....	
83,200	104,000	.36	.....	
86,400	108,000	.40	.....	
89,600	112,000	.48	.....	
92,800	116,000	.59	.....	
96,000	120,000	.84	.....	
96,900	121,125	1.11	.....	Tensile strength.
92,100	.....	.....	.....	At time of rupture.
0	0	1.29	.....	=12.9 per cent.

Elongation of inch sections: ″.07, ″.10, ″.10, ″.12, ″.15, ″.25*, ″.16, ″.14, ″.12, ″.08.
Diameter at fracture, ″.89. Area, .622 square inch.
Contraction of area, 22.3 per cent.
Fractured 5″.5 from the neck. Appearance, granular, silky center.

No. 4469.

RAIL No. 34.

Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0012	.....	
10,000	10,000	.0028	.....	
20,000	20,000	.0062	.....	
30,000	30,000	.0097	0.	
35,000	35,000	.0113	.....	
36,000	36,000	.0117	.....	
37,000	37,000	.0122	.....	
38,000	38,000	.0127	.....	
39,000	39,000	.0132	.....	
40,000	40,000	.0138	.0008	Elastic limit.
41,000	41,000	.0995	.....	
42,000	42,000	.1060	.....	
43,000	43,000	.1140	.....	
44,000	44,000	.1250	.....	
45,000	45,000	.1380	.....	
46,000	46,000	.1510	.....	
47,000	47,000	.1648	.....	
48,000	48,000	.1800	.....	
49,000	49,000	.1940	.....	
50,000	50,000	.2100	.....	
52,000	52,000	.25	.....	
54,000	54,000	.29	.....	
56,000	56,000	.33	.....	
58,000	58,000	.38	.....	
60,000	60,000	.43	.....	
62,000	62,000	.50	.....	
64,000	64,000	.56	.....	
66,000	66,000	.66	.....	
68,000	68,000	.76	.....	
70,000	70,000	.95	.....	
72,000	72,000	1.24	.....	
73,140	73,140	1.78	.....	Tensile strength.
63,700	.....	.....	.....	At time of rupture.
0	0	2.61	.....	=26.1 per cent.

Elongation of inch sections: ″.15, ″.22, ″.24, ″.26, ″.26, ″.40, ″.47*, ″.25, ″.22, ″.14.

Diameter at fracture, ″.86. Area, .581 square inch.

Contraction of area, 41.9 per cent.

Fractured 5″ from the neck. Appearance, silky, interspersed with fine granulation at the circumference. Several fine transverse cracks developed in surface of stem in vicinity of place of rupture, at one of which cracks rupture commenced.

SPECIMENS FROM A TO G TAKEN FROM HEAD OF RAIL NO. 34, MARKED IN THE ORDER THEY WERE TAKEN OUT, BEGINNING AT END OF RAIL.

No. 4487.

RAIL NO. 34.

Specimen A.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0007	.....	
2,500	10,000	.0017	.....	
5,000	20,000	.0037	.....	
7,500	30,000	.0058	.....	
8,750	35,000	.0068	.....	
9,000	36,000	.0070	.....	
9,250	37,000	.0072	.....	Elastic limit
9,500	38,000	.0078	.....	
9,750	39,000	.0360	.....	
10,000	40,000	.0600	.....	
10,250	41,000	.0650	.....	
10,500	42,000	.0740	.....	
10,750	43,000	.0790	.....	
11,000	44,000	.0900	.....	
11,250	45,000	.0970	.....	
11,500	46,000	.1075	.....	
11,750	47,000	.1155	.....	
12,000	48,000	.1250	.....	
12,250	49,000	.1350	.....	
12,500	50,000	.1460	.....	
13,000	52,000	.1720	.....	
13,500	54,000	.1980	.....	
14,000	56,000	.2280	.....	
14.500	58,000	.2630	.....	
15,000	60,000	.31	.....	
15,500	62,000	.37	.....	
16,000	64,000	.42	.....	
16,500	66,000	.50	.....	
17,000	68,000	.62	.....	
17,500	70,000	.91	.....	
17,520	70,080	1.10	.....	Tensile strength.
0	0	1.30	.....	= 21.7 per cent.

Elongation of inch sections: ″.14, ″.18, ″.27, ″.39*, ″.17, ″.15.
Diameter at fracture, ″.39. Area, .1194 square inch.
Contraction of area, 52.2 per cent.
Fractured at middle of stem. Appearance, silky.

No. 4488.

RAIL NO. 34.

Specimen B.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0007	----------	
2,500	10,000	.0021	----------	
5,000	20,000	.0043	----------	
7,500	30,000	.0064	.0032	
8,750	35,000	.0070	.0097	Elastic limit.
9,000	36,000	.0081	----------	
9,250	37,000	.0086	----------	
9,500	38,000	.0140	----------	
9,750	39,000	.0245	----------	
10,000	40,000	.0285	----------	
10,250	41,000	.0348	----------	
10,500	42,000	.0435	----------	
10,750	43,000	.0480	----------	
11,000	44,000	.0575	----------	
11,250	45,000	.0630	----------	
11,500	46,000	.0720	----------	
12,000	48,000	.0878	----------	
12,500	50,000	.1060	----------	
13,000	52,000	.1275	----------	
13,500	54,000	.1480	----------	
14,000	56,000	.1720	----------	
14,500	58,000	.2000	----------	
15,000	60,000	.2380	----------	
15,500	62,000	.28	----------	
16,000	64,000	.32	----------	
16,500	66,000	.39	----------	
17,000	68,000	.47	----------	
17,500	70,000	.60	----------	
18,000	72,000	1.00	----------	Tensile strength.
0	0	1.32	----------	=22 per cent.

Elongation of inch sections: ″.16, ″.18, ″.17, ″.20, ″.42*, ″.19.
Diameter at fracture, ″.42. Area, .139 square inch.
Contraction of area, 44.4 per cent.
Fractured 1″.6 from the neck. Appearance, silky.

No. 4489.

RAIL NO. 34.

Specimen C.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0007	.....	
2,500	10,000	.0017	.....	
5,000	20,000	.0037	.....	
7,500	30,000	.0058	0.	
8,500	34,000	.0074	.....	
8,750	35,000	.0077	.0008	Elastic limit.
9,000	36,000	.0084	.....	
9,250	37,000	.0092	.....	
9,500	38,000	.0120	.....	
9,750	39,000	.0147	.....	
10,000	40,000	.0165	.....	
10,250	41,000	.0201	.....	
10,500	42,000	.0250	.....	
11,000	44,000	.0350	.....	
11,500	46,000	.0458	.....	
12,000	48,000	.0585	.....	
12,500	50,000	.0740	.....	
13,000	52,000	.0900	.....	
13,500	54,000	.1075	.....	
14,000	56,000	.1290	.....	
14,500	58,000	.1520	.....	
15,000	60,000	.1780	.....	
15,500	62,000	.2075	.....	
16,000	64,000	.2430	.....	
16,500	66,000	.29	.....	
17,000	68,000	.36	.....	
17,500	70,000	.42	.....	
18,000	72,000	.56	.....	
18,260	73,040	.79	.....	Tensile strength.
0	0	1.00	.....	=16.7 per cent.

Elongation of inch sections: ″.08, ″.10, ″.12, ″.14, ″.19, ″.37*.
Diameter at fracture, ″.40. Area, .1257 square inch.
Contraction of area, 49.7 per cent.
Fractured 1″ from the neck. Appearance, silky.

No. 4490.

RAIL NO. 34.

Specimen D.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0007	.....	
2,500	10,000	.0017	.....	
5,000	20,000	.0037	.....	
7,500	30,000	.0060	0.	
8,250	33,000	.0067	.....	
8,500	34,000	.0071	.....	
8,750	35,000	.0073	.0005	Elastic limit.
9,000	36,000	.0095	.....	
9,250	37,000	.0158	.....	
9,500	38,000	.0280	.....	
9,750	39,000	.0385	.....	
10,000	40,000	.0445	.....	
10,500	42,000	.0600	.....	
11,000	44,000	.0740	.....	
11,500	46,000	.0900	.....	
12,000	48,000	.1075	.....	
12,500	50,000	.1270	.....	
13,000	52,000	.1480	.....	
13,500	54,000	.1740	.....	
14,000	56,000	.2020	.....	
14,500	58,000	.2350	.....	
15,000	60,000	.27	.....	
15,500	62,000	.32	.....	
16,000	64,000	.39	.....	
16,500	76,000	.46	.....	
17,000	78,000	.58	.....	
17,500	70,000	.76	.....	
17,600	70,400	.95	.....	Tensile strength.
0	0	1.21	.....	=20.2 per cent.

Elongation of inch sections: ″.17, ″.23, ″.43*, ″.17, ″.12, ″.09.
Diameter at fracture, ″.40. Area, ″.1257 square inch.
Contraction of area, 49.7 per cent.
Fractured 2″.9 from the neck. Appearance, silky.

No. 4491.

RAIL NO. 34.

Specimen E.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0007	.....	
2,500	10,000	.0017	.....	
5,000	20,000	.0037	.....	
7,500	30,000	.0059	0.	
8,250	33,000	.0066	.....	
8,500	34,000	.0069	.....	
8,750	35,000	.0071	.....	
9,000	36,000	.0072	.....	
9,250	37,000	.0074	.....	Elastic limit.
9,500	38,000	.0081	.....	
9,750	39,000	.0091	.....	
		.0580	.....	
10,000	40,000	.0638	.....	
10,250	41,000	.0688	.....	
10,500	42,000	.0776	.....	
11,000	44,000	.0948	.....	
11,500	46,000	.1135	.....	
12,000	48,000	.1300	.....	
12,500	50,000	.1530	.....	
13,000	52,000	.1760	.....	
13,500	54,000	.2025	.....	
14,000	56,000	.2335	.....	
14,500	58,000	.28	.....	
15,000	60,000	.32	.....	
15,500	62,000	.37	.....	
16,000	64,000	.42	.....	
16,500	66,000	.52	.....	
17,000	68,000	.62	.....	
17,480	69,920	1.02	.....	Tensile strength.
0	0	1.22	.....	=20.3 per cent.

Elongation of inch sections: ″.31*, ″.28, ″.17, ″.17, ″.15, ″.14.
Diameter at fracture, ″.42. Area, .1385 square inch.
Contraction of area, 44.6 per cent.
Fractured 1″.15 from the neck. Appearance, silky.

No. 4492.

RAIL NO. 34.

Specimen F.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0008	.....	
2,500	10,000	.0019	.....	
5,000	20,000	.0039	.....	
7,500	30,000	.0063	.0002	
7,750	31,000	.0065	.....	
8,000	32,000	.0067	.....	
8,250	33,000	.0069	.....	
8,500	34,000	.0073	.....	
8,750	35,000	.0075	.0005	Elastic limit.
9,000	36,000	.0082	.....	
9,250	37,000	.0086	.....	
9,500	38,000	.0250	.....	
9,750	39,000	.0500	.....	
10,000	40,000	.0552	.....	
10,500	42,000	.0720	.....	
11,000	44,000	.0850	.....	
11,500	46,000	.1040	.....	
12,000	48,000	.1230	.....	
12,500	50,000	.1440	.....	
13,000	52,000	.1675	.....	
13,500	54,000	.1940	.....	
14,000	56,000	.2220	.....	
14,500	58,000	.26	.....	
15,000	60,000	.30	.....	
15,500	62,000	.35	.....	
16,000	64,000	.40	.....	
16,500	66,000	.50	.....	
17,000	68,000	.61	.....	
17,500	70,000	.88	.....	
17,580	70,320	1.07	.....	Tensile strength.
0	0	1.46	.....	= 24.3 per cent.

Elongation of inch sections: ″.15, ″.18, ″.30, ″.44*, ″.22, ″.17.
Diameter at fracture, ″.38. Area, .1134 square inch.
Contraction of area, 54.6 per cent.
Fractured 3″.7 from the neck. Appearance, silky.

No. 4493.

RAIL NO. 34.

Specimen G.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0019	.....	
5,000	20,000	.0039	.....	
7,500	30,000	.0061	.0002	
8,000	32,000	.0067	.....	
8,250	33,000	.0070	.....	
8,500	34,000	.0073	.....	
8,750	35,000	.0076	.0006	Elastic limit.
9,000	36,000	.0081	.....	
9,250	37,000	.0087	.....	
9,500	38,000	.0335	.....	
9,750	39,000	.0480	.....	
10,000	40,000	.0605	.....	
10,500	42,000	.0770	.....	
11,000	44,000	.0940	.....	
11,500	46,000	.1120	.....	
12,000	48,000	.1310	.....	
12,500	50,000	.1525	.....	
13,000	52,000	.1770	.....	
13,500	54,000	.2030	.....	
14,000	56,000	.2345	.....	
14,500	58,000	.28	.....	
15,000	60,000	.32	.....	
15,500	62,000	.38	.....	
16,000	64,000	.44	.....	
16,500	66,000	.51	.....	
17,000	68,000	.68	.....	
17,500	70,000	.97	.....	Tensile strength.
0	0	1.42	.....	= 23.7 per cent.

Elongation of inch sections: ″.13, ″.17, ″.30, ″.38*, ″.24, ″.20.
Diameter at fracture, ″.38. Area, .1134 square inch.
Contraction of area, 54.6 per cent.
Fractured at middle of stem. Appearance, silky.

No. 4478.

Rail No. 35.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0014	.....	
5,000	10,000	.0031	.....	
10,000	20,000	.0067	.....	
15,000	30,000	.0102	0.	
17,500	35,000	.0121	.0002	
18,000	36,000	.0127	.....	
18,500	37,000	.0130	.....	
19,000	38,000	.0134	.....	
19,500	39,000	.0140	.....	
20,000	40,000	.0147	.0010	Elastic limit.
20,500	41,000	.0170	.....	
21,000	42,000	.0195	.....	
21,500	43,000	.0347	.....	
22,000	44,000	.0470	.....	
22,500	45,000	.0578	.....	
23,000	46,000	.0670	.....	
23,500	47,000	.0785	.....	
24,000	48,000	.0880	.....	
24,500	49,000	.0998	.....	
25,000	50,000	.1120	.....	
25,500	51,000	.1240	.....	
26,000	52,000	.1350	.....	
26,500	53,000	.1500	.....	
27,000	54,000	.1620	.....	
27,500	55,000	.1780	.....	
28,000	56,000	.1920	.....	
28,500	57,000	.2075	.....	
29,000	58,000	.2240	.....	
29,500	59,000	.2400	.....	
30,000	60,000	.2590	.....	
31,000	62,000	.30	.....	
32,000	64,000	.35	.....	
33,000	66,000	.40	.....	
34,000	68,000	.46	.....	
35,000	70,000	.52	.....	
36,000	72,000	.60	.....	
37,000	74,000	.70	.....	
38,000	76,000	.86	.....	Cracks opened in surface of stem.
39,000	78,000	1.18	.....	
39,240	78,480	1.37	.....	Tensile strength.
0	0	1.63	.....	= 16.3 per cent.

Elongation of inch sections: ″.10, ″.13, ″.14, ″.16, ″.17, ″.15, ″.25*, ″.22, ″.18, ″.13.

Diameter at fracture, ″.70. Area, .385 square inch.

Contraction of area, 23 per cent.

Fractured 3″.7 from the neck. Appearance, granular, radiating from a dull silky spot in the circumference.

Six rows of fine transverse cracks developed along surface of stem.

No. 4483.

Rail No. 36.

Diameter, ″.874.
Sectional area, .60 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
600	1,000	0.	0.	Initial load.
3,000	5,000	.0012	.....	
6,000	10,000	.0030	.....	
12,000	20,000	.0062	.....	
18,000	30,000	.0098	.....	
21,000	35,000	.0113	.....	
24,000	40.000	.0131	0.	
27,000	45,000	.0150	.....	
30,000	50,000	.0170	.0002	
30,600	51,000	.0173	.....	
31,200	52,000	.0179	.....	
31,800	53,000	.0182	.....	
32,400	54,000	.0188	.....	
33,000	55,000	.0192	.....	Elastic limit.
33,600	56,000	.0220	.....	
34,200	57,000	.0272	.....	
34,800	58,000	.0520	.....	
35,400	59,000	.0785	.....	
36,000	60,000	.0850	.....	
37,200	62,000	.1000	.....	
38,400	64,000	.1130	.....	
39,600	66,000	.1300	.....	
40,800	68,000	.1450	.....	
42,000	70,000	.1610	.....	
43,200	72,000	.1795	.....	
44,400	74,000	.2000	.....	
45,600	76,000	.2180	.....	
46,800	78,000	.2390	.....	
48,000	80,000	.2620	.....	
49,200	82,000	.28	.....	
50,400	84,000	.31	.....	
51,600	86,000	.34	.....	
52,800	88,000	.38	.....	
54,000	90,000	.42	.....	
55,200	92,000	.45	.....	
56,400	94,000	.51	.....	
57,600	96,000	.57	.....	
58,800	98,000	.63	.....	
60,000	100,000	.72	.....	
61,200	102,000	.84	.....	
62,400	104,000	1.11	.....	
62,610	104,350	1.30	.....	Tensile strength.
61,800	.....	.....	.....	At time of rupture.
0	0	1.38	.....	=13.8 per cent.

Elongation of inch sections: ″.09, ″.13, ″.14,″ .13, ″.17, ″.21*, ″.14, ″.13, ″.13, ″.11.

Diameter at fracture, ″.78. Area, .478 square inch.

Contraction of area, 20.3 per cent.

Fractured 5″.5 from the neck. Appearance, fine, granular, radiating from a dull silky spot at the circumference.

No. 4484.

Rail No. 37.

Diameter, ″.874.
Sectional area, .60 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
600	1,000	0.	0.	Initial load.
3,000	5,000	.0015	.....	
6,000	10,000	.0032	.....	
12,000	20,000	.0066	.....	
18,000	30,000	.0098	.....	
24,000	40,000	.0136	.0001	
27,000	45,000	.0159	.0009	
27,600	46,000	.0166	.....	
28,200	47,000	.0172	.....	Elastic limit.
28,800	48,000	.0181	.....	
29,400	49,000	.0227	.....	
30,000	50,000	.0450	.....	
30,600	51,000	.0728	.....	
31,200	52,000	.0775	.....	
31,800	53,000	.0835	.....	
32,400	54,000	.0917	.....	
33,000	55,000	.1020	.....	
33,600	56,000	.1107	.....	
34,200	57,000	.1230	.....	
34,800	58,000	.1300	.....	
35,400	59,000	.1390	.....	
36,000	60,000	.1540	.....	
37,200	62,000	.1785	.....	
38,400	64,000	.2017	.....	
39,600	66,000	.2290	.....	
40,800	68,000	.2560	.....	
42,000	70,000	.2880	.....	
43,200	72,000	.31	.....	
44,400	74,000	.36	.....	
45,600	76,000	.40	.....	
46,800	78,000	.46	.....	
48,000	80,000	.51	.....	
49,200	82,000	.60	.....	
50,400	84,000	.70	.....	
51,600	86,000	.84	.....	
52,800	88,000	1.07	.....	
53,350	88,920	.....	.....	Tensile strength.
46,800	.....	.....	.....	At time of rupture.
0	0	1.86	.....	= 18.6 per cent.

Elongation of inch sections: ″.13, ″.42*, ″.20, ″.20, ″.17, ″.19, ″.17, ″.13, ″.14, ″.11.

Diameter at fracture, ″.67. Area, .353 square inch.

Contraction of area, 41.2 per cent.

Fractured 3″.1 from the neck. Appearance, silky, interspersed with granular metal at the circumference.

TABULATION OF TRANSVERSE TESTS.

No. of test.	No. of rail.	Brand.	Height.	Width of base.	Weight per yard.	Moment of inertia.	Distance between end supports.	Loaded on—	Deflections above initial load under total loads in pounds of—				Elastic limit.		Maximum load applied or ultimate strength.		Apparent modulus of elasticity per square inch.
									20,000,	40,000,	60,000,	80,000.	Total.	Maximum fiber stress per square inch.	Total.	Maximum fiber stress per square inch.	
			Inches.	*Inches.*	*Pounds.*		*Inches.*		*Inch.*	*Inch.*	*Inch.*	*Inches.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
89	9	Part of brand in sight: "Landore Siemen".	3.85	3.78	58.9	10.712	22.1	Base..	.03	.05	.12	.46	.....	.....	84,180	86,400	.....
58	15	Made by North Chicago Rolling Mill Co., Chicago, Ill.	5.17	5.00	83.5	29.455	30	Head .	.0193	.0379	.0560	.0735	108,000	71,500	*140,000	92,680	20,910,000
78	18	"Barrow Steel 1868:".....	4.00	3.75	54.5	11.089	30	Head .	.0393	.0801	.1296	.70	40,000	54,920	103,480	142.080	24,030.000
79	18	.....	.....	.....	.....	.....	30	Base..	.03	.08	.13	.68	.....	.....	91,850	126,110	.....
80	21	"P S Co 1879:".....	3.93	3.78	58	11.789	30	Head .	.0413	.0840	.2460	.98	40,000	51,400	88,000	113,090	22.010.000
81	21	.....	.....	.....	.....	.....	30	Head .	.04	.10	.....	.....	.....	.....	51,400	66.050	.....
82	21	.....	.....	.....	.....	.....	30	Base..	.04	.08	.25	.....	.....	.....	74,900	96,250	.....
83	22	"12 A & R I & S[c] Troy Steel 1883 12".	4.26	4.28	65.4	14.923	30	Head	.0340	.0688	.1750	.66	46,000	50,850	97,900	108,250	21,640.000
84	22	.....	.....	.....	.....	.....	30	Base..	.04	.08	.18	.58	.....	.....	91,200	100,840	.....
85	23	"Lack[a] I & C. Co Scranton 4-89"	4.98	5.00	74.5	25.206	30	Head .	.0230	.0459	.0662	.0880	94,000	71,610	169,200	128,890	20,530.000
91	24	"G. H. Hutte 1880".....	3.95	3.83	56.6	10.708	24	Base..	.0252	.0497	.0748	.....	64,000	72,440	79,800	90,330	22,130,000
60	24	.....	.....	.....	.....	.....	30	Head .	.0393	.0793	.1364	.8135	52,000	73,580	*82.000	116,020	26,100.000
61	25	"Cammel Sheffield Toughened steel 1873".	4.37	3.91	60	14.752	30	Head .	.0321	.0662	.1451	.8118	40,000	44,540	*82,000	91,300	23,310,000
94	25	.....	.....	.....	.....	.....	22.1	Head .	.....	.....	.....	.....	.....	.....	133,000	109,090	.....
62	26	Paint on head "22-8," said to be made by Chas. Cammel.	3.71	3.98	56.1	9.757	30	Head .	.0448	.1015	.....	.....	32,000	47,960	*54,300	81,390	24,130,000
63	27	"John Brown & Co. Sheffield Atlas Steel $\frac{7}{74}$ Sec. 68".	4.47	3.96	64.19	16.309	30	Head .	.0316	.0630	.1017	.5271	50,000	53,340	*90,000	96,020	22,030,000
64	29	Said to be made by John Brown.	3.94	3.87	41.4	11.179	30	Head .	.0481	.1428	.....	.....	30,000	41,460	*65,000	89,830	21,070,000
65	30	"B I. Co Steel 76".....	3.95	3.97	58.05	11.872	30	Head .	.0398	.0792	.2502	.....	40,000	51,300	*70,000	89,770	22,880,000
74	30	.....	.....	.....	.....	.....	22.1	Base..	.....	.....	.....	.....	.....	.....	95,700	90,410	.....
75	30	.....	.....	.....	.....	.....	22.1	Head .	.....	.....	.....	.....	.....	.....	103,900	98,160	.....
66	32	"A-B-S-89 111".....	4.50	4.18	65.02	16.745	30	Head .	.0285	.0577	.0887	.1397	60,000	61,810	100,000	103,020	22,460.000
67	34	"W I Co Steel 82".....	4.41	4.49	64.66	16.496	30	Head .	.0297	.0618	.1790	1.08	42,000	43,150	80,000 76,000	82,200 78,090	21,560,000
68	34	.....	4.41	.....	.....	.....	54	Base..	.1563	.....	.....	.....	.....	.....	33,400	61,770	.....

92	34	.....	4.20	.....	.....	.....	30	Base..	.....	.....	.....	.....	34,000	37,760	89,500	104,400	21,710,000
93	34	.....	4.20	.....	.....	.....	17.1	Head.	.....	.....	.....	.....	.....	.....	168,000	106,350	.....
69	34	.....	4.41	.....	.....	.....	30	Base..	.....	.....	.....	.....	.....	.....	63,900	65,660	.....
70	34	.....	4.41	.....	.....	.....	30	Head.	.....	.....	.....	.....	.....	.....	99,800	102,550	.....
71	34	.....	4.41	.....	.....	.....	17	Head.	.....	.....	.....	.....	.....	.....	162,000	94,330	.....
72	34	.....	4.25	.....	.....	.....	30	Base..	.....	.....	.....	.....	.....	.....	54,900	.....	.....
72*a*	34	.....	4.25	.....	.....	.....	17.1	Base..	.....	.....	.....	.....	.....	.....	152,000	.....	.....
73	34	.....	4.41	.....	.....	.....	22.1	Head.	.....	.....	.....	.....	.....	.....	122,100	92,420	.....
76	34	.....	4.41	.....	.....	.....	17.1	Base..	.....	.....	.....	.....	.....	.....	93,580	54,810	.....
77	34	.....	4.41	.....	.....	.....	22.1	Base..	.....	.....	.....	.....	.....	.....	78,100	59,120	.....
88	35	"C R M Co 12 75"	3.66	3.74	48.71	8.590	30	Base..	.0578	.15	.....	.....	24,000	39,180	50,800	82,940	20,860,000
90	35	.....	.....	.....	.....	.....	17.1	Head.	.....	.....	.....	.....	.....	.....	126,800	118,010	.....
86	36	"Wilson Cammel Cos. Steel Sec. $\frac{6}{74}$, Dronfield".	3.97	3.74	60.69	11.949	30	Base..	.0391	.0788	.14	.40	40,000	51,970	109,200	141,880	22,840,000
87	37	.....do.....	3.97	3.72	60.62	11.949	30	Base..	.0368	.0761	.1610	.64	44,000	57,170	85,900	111,610	24,400,000

* Ultimate strength not reached.

TABULATION OF TENSION SPECIMENS FROM HEADS.

No. of test.	No. of rail.	Brand.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 10 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
			Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*		" " " " " " " " " "
4466	8	"A. R. I. & S. Co., Troy steel, 1884, 23."	1.128	1.00	39,000	85,660	20.6	40.6	Silky and fine granular	.13, .15, .19, .23, .48*, .23, .19, .17, .15, .14
4477	9	Part of brand in sight "Landore Siemen."	.798	.50	29,000	76,240	20.0	31.6	Granular 90 per cent, silky spot 10 per cent.	.14, .17, .19, .21, .36*, .25, .18, .19, .18, .13
4470	10	Rolled by the Chicago Rolling Mill Co., Chicago, Ill.	1.129	1.00	51,000	111,080	13.7	30.6	Fine granular, silky center.	.07, .11, .13, .13, .32*, .22, .12, .10, .09, .08
4471	11		1.129	1.00	50,000	101,660	16.3	41.9	Silky and fine granular	.09, .11, .13, .12, .15, .41*, .26, .15, .12, .09
4472	12		1.129	1.00	57,000	113,990	15.5	30.6	Fine granular, silky center.	.09, .12, .15, .16, .35*, .20, .14, .13, .13, .08
4473	13		1.129	1.00	49,000	99,420	16.9	33.5	Granular, silky spot	.09, .12, .12, .17, .23, .37*, .18, .15, .15, .11
4474	14		1.129	1.00	50,000	109,200	7.9	8.4	Granular, fractured in head.	.06, .09, .08, .09, .08, .07, .09, .08, .08, .07
4459	15		.714	.40	57,000	111,800	14.5	29.3	Granular	.08, .12, .12, .17, .14, .18, .26*, .14, .13. .11
4475	16		1.129	1.00	53,000	111,880	15.2	30.6	Granular, silky center	.09, .14, .16, .15, .31*, .22, .14, .12, .11, .08
4476	17		1.129	1.00	55,000	111,380	13.9	30.6	Granular, silky center	.09, .12, .12, .16, .31*, .18, .13, .10, .11, .07
4453	18	"Barrow steel, 1868."	.714	.40	54,000	89,450	16.9	46.9	Silky and granular	.10, .14, .15, .22, .40*, .16, .17, .15, .11, .09
4485	19	"6 Sec. No. 65"	.874	.60	43,000	93,100	17.6	37.7	Granular, silky center	.13, .18, .18, .39*, .21, .15, .15, .13, .13, .11
4486	20	"Crawshaw, B 4"	.564	.25	32,000	52,760	§3.0	15.2	Coarse granular 70 per cent, dark spongy 30 per cent.	.04, .04, .06, .08*, .07*, .04
4458	21	"P. S. Co., 1879"	.714	.40	35,000	85,550	18.7	46.9	Fine silky, trace of granulation.	.13, .18, .42*, .20, .17, .15, .15, .16, .16, .15
4454	22	"12 A. & R. I. & S^{c} Troy Steel, 1883, 12."	.714	.40	39,000	90,600	18.3	38,4	Silky and fine granular	.16, .20, .17, .28, .32*, .17, .15, .14, .12, .12
4479	23	"Lack^{a} I. & C. Co., Scranton, 4–89."	.874	.60	53,000	112,000	7.3	9.8	Granular	.06, .07, .08, .07, .08, .09, .07, .08, .07, .06
4480	23	....do	.874	.60	44,000	112,130	12.6	30.2	Granular, dull silky spot	.07, .11, .11, .13, .27*, .19, .10, .09, .11, .08
4455	24	"G. H. Hutte, 1880"	.714	.40	49,000	86,700	20.2	50.9	Fine silky and fine granular.	.13, .15, .16, .16, .18, .19, .46*, .24, .21, .14
4464	24	....do	.714	.40	50,000	86,525	18.7	51.0	Silky and fine granular	.12, .16, .17, .15, .12, .18, .47*, .20, .17, .13
4460	25	"Cammel Sheffield Toughened Steel, 1873."	.713	.40	40,000	74,250	20.5	49.0	....do	.13, .17, .18, .18, .18, .44*, .25, .23, .16, .13
4461	26	Paint on head "22–8," said to be made by Chas. Cammel.	.714	.40	39,000	65,600	23.7	56.7	Silky	.32, .43*, .24, .21, .21, .22, .24, .20, .17, .13
4462	27	"John Brown & Co., Sheffield Atlas Steel $\frac{7}{74}$, Sec. 68."	.713	.40	37,000	77,475	14.5	52.9	....do	.10, .20, .47*, .14, .09, .07, .12, .09, .10, .07
4481	28	"Barrow Steel, 1873, ∴∴∴ 55"	.874	.60	39,000	68,030	20.8	57.5	Fine silky	.10, .13, .10, .09, .16, .35, .54*, .26, .21, .14
4456	29	Said to be made by John Brown	.714	.40	29,000	75,700	14.0	24.5	Granular, silky spot	.08, .12, .11, .11, .12, .13, .14, .17, .24*, .18
4557	29		1.128	1.00	31,000	74,000	†7.2	10.1	Granular, dull spot	.11, .09, .08, .08, .07, .09, .07, .08, .07, .07 .06, .05, .05, .04, .06, .07, .07, .08, .08, .08 .09, .09, .08, .09
4457	30	"B. I. Co. Steel, 76"	.714	.40	39,000	66,000	2.9	6.5	Granular, dull silky spot	.02, .02, .03, .03, .03, .05*, .03, .03, .03, .02
	30	....do	.713	.40	40,000	70,000	3.3	6.5	Granular, dull spot	.03*, .04, .02, .04, .03, .04, .02, .05, .03, .03
4482	31	"Dowlais Steel, 7 70, guaranteed."	.874	.60	39,000	85,220	15.9	41.2	Silky and fine granular	.11, .14. .15, .17, .30*, .30*, .14, .11, .09, .08
4463	32	"A-B-S., 89 111"	.714	.40	52,000	110,000	14.1	34.0	Fine granular, dull silky center.	.09, .11, .12, .12, .14, .12, .13, .14, .31*, .13

4558	32	------do	1.128	1.00	51,000	110,850	†11.0	32.1	Granular, dull spot	.07, .09, .07, .10, .09, .10, .09, .07, .08, .07 .06, .05, .07, .07, .08, .11, .11, .12, .13, .15 .25, .32*, .15, .11
4467	33	"Scranton Steel Co., 3, '89"	1.129	1.00	58,000	120,580	7.6	.....	Granular, fractured in head.	
4468	33	------do	1.0092	.80	60,000	121,125	12.9	22.3	Granular, silky center	.07, .10, .10, .12, .15, .25*, .16, .14, .12, .08
4469	34	"W. I. Co. Steel, '82"	1.129	1.00	40,000	73,140	§26.1	41.9	Silky and fine granular	.15, .22, .24, .26, .26, .40, .47*, .25, .22, .14
4487	34	------do	.564	.25	37,000	70,080	§21.7	52.2	Silky	.14, .18, .27, .39*, .17, .15
4488	34	------do	.564	.25	35,000	72,000	§22.0	44.4	------do	.16, .18, .17, .20, .42*, .19
4489	34	------do	.564	.25	35,000	73,040	§16.7	49.7	------do	.08, .10, .12, .14, .19, .37*
4490	34	------do	.564	.25	35,000	70,400	§20.2	49.7	------do	.17, .23, .43*, .17, .12, .09
4491	34	------do	.564	.25	37,000	69,920	§20.3	44.6	------do	.31*, .28, .17, .17, .15, .14
4492	34	------do	.564	.25	35,000	70,320	§24.3	54.6	------do	.15, .18, .30, .44*, .22, .17
4493	34	------do	.564	.25	35,000	70,000	§23.7	54.6	------do	.13, .17, .30, .38*, .24, .20
4478	35	"C. R. M. Co., 12, 75"	.798	.50	40,000	78,480	16.3	23 0	Granular, dull silky spot	.10, .13, .14, .16, .17, .15, .25*, .22, .18, .13
4483	36	"Wilson Cammel Co.'s Steel, Sec. $\frac{6}{74}$, Dronfield."	.874	.60	55,000	104,350	13.8	20.3	Fine granular, dull silky spot.	.09, .13, .14, .13, .17, .21*, .14, .13, .13, .11
4484	37	------do	.874	.60	47,000	88,920	18.6	41.2	Silky and granular	.13, .42*, .20, .20, .17, .19, .17, .13, .14, .11

† Elongation measured in 20 inches.

§ Elongation measured in 6 inches

SPECIFIC GRAVITY AND HARDNESS OF HEADS OF RAILS.

[Specimens 1 inch diameter by 1 inch long taken from heads of tension specimens.]

No. of rail.	Brand.	Specific gravity.	Hardness.
10	Rolled by No. Chicago Rolling Mill Co., Chicago, Ill	7.8534	25.13
11		7.8436	21.89
12		7.8479	25.28
13		7.8476	21.52
16		7.8485	27.32
17		7.8233	25.13
18	"Barrow Steel, 1868 : : "	7.8235	19.29
19	"6 sec., No. 65 "	7.8559	18.09
21	"P. S. Co., 1879 "	7.8420	14.69
22	"12 A. & R. I. & S. C. Troy Steel, 1883–12 "	7.8331	18.19
23	"Lacka I. & C. Co., Scranton, 4–89 "	7.8387	26.04
24	"G. H. Hutte, 1880 "	7.8266	17.53
25	"Cammel Sheffield Toughened Steel, 1873 "	7.8555	14.26
26		7.8568	12.72
27	"John Brown & Co., Sheffield Atlas Steel $\frac{7}{74}$, Sec. 68 "	7.8487	16.23
27		7.8471	17.26
28	"Barrow Steel, 1873 : : : : 55 "	7.8555	12.48
29		7.8077	15.21
29		7.8245	13.40
30	"B. I. Co. Steel, 76 "	7.8111	17.17
31	"Dowlais Steel, 7–70, guaranteed "	7.8566	17.35
32	"A–B–S, 89, 111 "	7.8403	26.67
33	"Scranton Steel Co., 3, 89 "	7.8484	30.14
34	"W. I. Co. Steel "	7.8523	17.72
35	"C. R. M. Co.,12, 75 "	7.8435	15.28
36	"Wilson Cammel Co.'s Steel, Sec. $\frac{6}{74}$, Dronfield "	7.8348	23.57
37		7.8272	18.58

TENSION SPECIMENS FROM BASES.

No. of test.	No. of rail.	Dimensions.		Sectional area.	Elastic limit.		Tensile strength		Length of stem.	Elongation of stem.		Area of fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.		Inches.	Per cent.				
		Inches.	*Inch.*	*Sq. in.*	*Pounds*	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*			" " *Sq. in*	*Per ct.*		" " " " " " " " "
5209	19	1.507	.59	.889	44,800	50,390	88,620	99,690	8	1.07	13.4	1.42 × .55 = .781	12.1	Granular, radiating from a dull spot at corner.	.10, .11, .16*, .13, .13, .15, .14, 15.
5210	20	1.563	.50	.782	28,200	36,060	44,790	57,280	6	.79	13.2	1.47 × .47 = .691	11.6	Coarse granular...	.11, .11, .10, .12, .22*, 13.
5211	23	1.515	.49	.742	46,500	62,670	82,300	110,920	18	1.28	7.1	1.33 × .38 = .505	31.9	Granular oblique surface of fracture next base of rail.	.07, .07, .06, .08, .05, .07, .05, .05, .06, .23*, .11, .07, .04, .06, .04, .06, .06, .05.
5212	27	1.510	.59	.891	45,200	50,730	74,410	83,510	6	1.18	19.7	1.22 × .46 = .561	37.0	Silky.....	.40*, .29, .12, .11, .14, .12.
5213	29	1.514	.50	.757	30,200	39,890	54,020	71,360	18	2.21	12.3	1.26 × .41 = .517	31.7	Silky, oblique...	.21, .43, .18, .15, .10, .08, .07, .07, .08, .10, .06, .07, .10, .09, .11, .11, .13, .07.
5214	34	1.528	.48	.733	28,550	38,950	51,720	70,560	18	3.37	18.7	1.18 × .35 = .413	43.7	Silky.....	.13, .13, .13, .15, .16, .16, .15, .18, .13, .21, .25, .60*, .23, .17, .17, .14, .14, .14.
5215	34	1.490	.43	.641	29,400	45,870	49,480	77,190	20	2.27	11.4	1.20 × .33 = .396	38.2	....do.....	.09, .08, .10, .10, .11, .12, .12, .17, .47*, .12, .09, .08, .07, .08, .09, .08, .06, .08, .08, .08.

NOTE.—Specimen No. 5215 was ".46 thickness except where base of rail had been spotted for transverse test, a distance of 1½". Fracture occurred at this section of reduced thickness.

TENSION SPECIMENS FROM WEBS.

No. of test.	No. of rail.	Dimensions.		Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 10 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
		Inches.	*Inch.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			" " *Sq in.*	*Per ct.*		" " " " " " " " " "
5205	23	1.013	.519	.526	32,200	61.220	57,780	109,850	.94	9.4	.88×.43=.378	28.1	Granular	.17, .15, .11, .09, .07, .07, .05, .07, .08, .08.
5206	34	1.131	.516	.584	25,300	43.320	41,020	70,240	1.92	1.12	.86×.36=.310	46.9	Silky	.13, .14, .13, .17, .13, .17, .17, .50*.21, .17.
5207	20	1.042	.653	.680	26,100	38.380	48,820	71,790	1.12	1.92	.96×.59=.566	16.8	Granular, with silky spot.	.13, .10, .09, .09, .08, .08, .12, .13, .14, .16.

COMPRESSION TESTS AND COLD FLOW.

[Specimens taken longitudinally from heads of rails.]

Compression tests were made with the specimens having the original dimensions, 4″ long by 1″.0092 diameter. After passing the elastic limit of the metal, but before reaching a well defined ultimate strength, which in specimens of these dimensions marks the time when lateral deflection progresses rapidly, the loads were released and the specimens cut down in length to about 2″.5.

The tests were resumed with the shortened specimens, which now under the higher compression loads yielded chiefly in radial directions; 300,000 pounds total load was applied to each, with the exception of the specimen from rail No. 30, which developed extensive shearing fractures at 260,000 pounds, when the test was discontinued.

The stress per square inch on the shortened specimens is computed from the sectional area as measured at the middle of its length at the time the given stress was applied.

No. 919.

Rail No. 15.

Length, 4″.
Diameter, 1″.0092.
Sectional area, 80 square inches.
Gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4,000	5,000	.0007	.....	
8,000	10,000	.0012	.....	
12,000	15,000	.0017	.....	
16,000	20,000	.0022	.....	
20,000	25,000	.0023	.....	
24,000	30,000	.0031	0.	
28,000	35,000	.0036	.....	
32,000	40,000	.0041	.....	
36,000	45,000	.0046	.....	
40,000	50,000	.0050	—.0001	
40,800	51,000	.0051	.....	
41,600	52.000	.0052	.....	
42,400	53,000	.0053	.....	
43,200	54,000	.0053	.....	
44,000	55,000	.0054	.....	
44,800	56,000	.0055	.....	
45,600	57,000	.0057	.....	Elastic limit.
46,400	58,000	.0070	.....	
47,200	59,000	.0105	.....	
48,000	60,000	.0130	.0062	
49,600	62,000	.0163	.....	
51,200	64,000	.0208	.....	
52,800	66,000	.0243	.....	
54,400	68,000	.0280	.....	
56,000	70,000	.0322	.0238	
57,600	72,000	.0358	.....	
59,200	74,000	.0395	.....	
60,800	76,000	.0435	.....	
62,400	78,000	.0480	.....	
64,000	80,000	.0520	.0422	
65,600	82,000	.0558	.....	
67,200	84,000	.0606	.....	
68,800	86,000	.0650	.....	
70,400	88,000	.0700	.....	
72,000	90,000	.0750	.0638	
73,600	92,000	.0795	.....	
75,200	94,000	.0848	.....	
76,800	96,000	.0905	.....	
78,400	98,000	.0960	.....	
80,000	100,000	.1016	.0893	

Specimen cut off, reducing length to 2″.506. Rested 13 days and test then resumed.

Applied loads.		Length.	Diameters.				Remarks.
			End A.	Middle.		End B.	
Total.	Per square inch.			Diameter.	Sectional area.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	*Sq.inches.*	*Inches.*	
0	0	2.506	1.0213	1.0238	.823	1.0236	
85,000	102,530	2.491	1.0234	1.0275	.829	1.0251	
90,000	107,050	2.473	1.0250	1.0316	.836	1.0278	
95,000	112,830	2.455	1.0278	1.0352	.842	1.0300	
100,000	116,140	2.407	1.0350	1.0468	.861	1.0356	
105,000	121,250	2.389	1.0383	1.0502	.866	1.0391	
110,000	124,430	2.349	1.0426	1.0606	.884	1.0426	
115,000	127,490	2.306	1.0505	1.0715	.902	1.0482	
120,000	130,150	2.253	1.057	1.0837	.922	1.055	
125,000	132,140	2.204	1.065	1.0974	.946	1.060	
130,000	136.270	2.161	1.068	1.1024	.954	1.065	
135,000	135,790	2.107	1.080	1.1252	.994	1.072	Quarters 1″.1310 diameter.
140,000	137,660	2.056	1.087	1.138	1.017	1.082	
150,000	140,060	1.963	1.109	1.168	1.071	1.094	
160,000	138,650	1.827	1.135	1.212	1.154	1.118	
170,000	141,200	1.747	1.137	1.238	1.204	1.131	Rested 16 hours.
180,000	139,860	1.652	1.176	1.280	1.287	1.150	
190,000	141,260	1.597	1.192	1.309	1.345	1.168	
200,000	142,650	1.516	1.207	1.336	1.402	1.187	
220,000	140,940	1.386	1.242	1.410	1.561	1.223	
240,000	140,430	1.284	1.288	1.475	1.709	1.265	
260,000	141,920	1.198	1.336	1.527	1.832	1.312	
280,000	141,560	1.122	1.383	1.587	1.978	1.360	
300,000	143,750	1.056	1.420	1.630	2.087	1.385	

Surface of specimen uniformly mottled, minute oblique shearing cracks started on cylindrical surface.

No. 920.

Rail No. 24.

Length, 4″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4,000	5,000	.0005	0.	
8,000	10,000	.0009	.....	
12,000	15,000	.0014	.....	
16,000	20,000	.0019	.....	
20,000	25,000	.0024	.....	
24,000	30,000	.0029	0.	
28,000	35,000	.0034	.....	
32,000	40,000	.0039	0.	
36,000	45,000	.0044	0.	
36,800	46,000	.0045	.....	
37,600	47,000	.0046	.....	
38,400	48,000	.0047	.....	
39,200	49,000	.0048	.....	
40,000	50,000	.0050	0.	Elastic limit.
40,800	51,000	.0054	.....	
41,600	52,000	.0059	.....	
42,400	53,000	.0151	.....	
43,200	54,000	.0180	.....	
44,000	55,000	.0220	.0160	
44,800	56,000	.0244	.....	
45,600	57,000	.0262	.....	
46,400	58,000	.0298	.....	
47,200	59,000	.0330	.....	
48,000	60,000	.0371	.0305	
51,200	64,000	.0490	.....	
52,800	66,000	.0574	.....	
54,400	68,000	.0650	.....	
56,000	70,000	.0728	.0650	
57,600	72,000	.0799	.....	
59,200	74,000	.0871	.....	
60,800	76,000	.0975	.....	
62,400	78,000	.1054	.....	
64,000	80,000	.1158	.1072	

Specimen cut off, reducing length to 2″.506. Rested 10 days and test resumed.

No. 24. No. 25. No. 26.

No. 920—Continued.

Applied loads.		Length.	Diameters.				Remarks.
			End A.	Middle.		End B.	
Total.	Per square inch.			Diameter.	Sectional area.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	*Sq.inches.*	*Inches.*	
0	0	2.506	1.0195	1.0238	.823	1.0254	
70,000	84,440	2.492	1.0220	1.0274	.829	1.0264	
75,000	88,860	2.450	1.0262	1.0367	.844	1.0300	
80,000	93,570	2.420	1.0312	1.0438	.855	1.0348	
85,000	97,370	2.376	1.0382	1.0543	.873	1.0416	
90,000	101,580	2.323	1.0450	1.0620	.886	1.0530	At quarter length 1″.0698 diameter.
95,000	103,830	2.273	1.0520	1.0792	.915	1.0600	
100,000	106,500	2.218	1.0632	1.0930	.939	1.0725	At quarter 1″.0970 diameter.
105,000	108,700	2.160	1.0860	1.1090	.966	1.0850	
110,000	111,000	2.105	1.0930	1.1235	.991	1.0885	Rested 20 hours without load.
120,000	119,050	2.066	1.095	1.133	1.008	1.106	
130,000	120,480	1.940	1.110	1.172	1.079	1.121	
140,000	122,380	1.838	1.125	1.207	1.144	1.135	
150,000	123,970	1.753	1.141	1.241	1.210	1.149	
160,000	124,710	1.652	1.164	1.278	1.283	1.170	
170,000	122,570	1.568	1.182	1.329	1.387	1.193	
180,000	122,530	1.494	1.210	1.368	1.469	1.218	
190,000	123.050	1.425	1.225	1.402	1.544	1.227	
200,000	123,150	1.358	1.264	1.438	1.624	1.264	
210,000	122,880	1.297	1.290	1.476	1.709	1.280	
220,000	123,780	1.244	1.300	1.508	1.786	1.308	
230,000	123,460	1.197	1.328	1.540	1.863	1.336	
240,000	123,650	1.152	1.355	1.572	1.941	1.362	
250,000	123,630	1.117	1.370	1.598	2.006	1.380	
260,000	125,540	1.080	1.397	1.624	2.071	1.400	
270,000	125,990	1.046	1.425	1.652	2.143	1.430	Tensile fracture started at a seam in the steel.
280,000	127,040	1.018	1.451	1.675	2.204	1.455	
300,000	130,320	.968	1.497	1.712	2.302	1.476	

The tensile fracture, which started at a seam in the steel, opened longitudinally ″.15; from this were started two shearing fractures, 45° in direction with the axis of specimen.

On the cylindrical surface there were 14 longitudinal lines shown where the metal was seamy or deficient in continuity. Some of the lines were very distinctly developed, others showing their presence by slight changes in color of surface.

No. 921.

Rail No. 25.

Length, 4″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4,000	5,000	.0003	0.	
8,000	10,000	.0007	.....	
12,000	15,000	.0011	.....	
16,000	20,000	.0015	.....	
20,000	25,000	.0020	.....	
24,000	30,000	.0025	0.	
28,000	35,000	.0030	0.	
28,800	36,000	.0031	.....	
29,600	37,000	.0032	.....	
30,400	38,000	.0033	.....	
31,200	39,000	.0034	.....	
32,000	40,000	.0035	0.	
32,800	41,000	.0036	.....	Elastic limit.
33,600	42,000	.0040	.....	
34,400	43,000	.0194	.....	
35,200	44,000	.0225	.....	
36,000	45,000	.0258	.0218	
36,800	46,000	.0283	.....	
37,600	47,000	.0315	.....	
38,400	48,000	.0351	.....	
39,200	49,000	.0386	.....	
40,000	50,000	.0419	.0373	
41,600	52,000	.0488	.....	
43,200	54,000	.0560	.....	
44,800	56,000	.0637	.....	
46,400	58,000	.0715	.....	
48,000	60,000	.0807	.0750	
49,600	62,000	.0875	.....	
51,200	64,000	.0979	.....	
52,800	66,000	.1075	.....	
54,400	68,000	.1173	.....	
56,000	70,000	.1287	.1220	

Rested eleven days, then cut off, reducing length to 2″.502. Present average diameter, 1″.0293.

Lines scored on cylindrical surface $\frac{1}{4}$″ apart.

No. 921—Continued.

Applied loads.		Length.	Diameters.				Remarks.
			End A.	Middle.		End B.	
Total.	Per square inch.			Diameter.	Sectional area.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	*Sq.inches.*	*Inches.*	
0	0	2.502	1.0293	1.0293	.832	1.0293	
60,000	72,120	2.502	1.0293	1.0293	.832	1.0293	
65,000	76,920	2.468	1.0302	1.0374	.845	1.0306	
70,000	81,210	2.426	1.0346	1.0480	.862	1.0350	
75,000	85,320	2.384	1.0395	1.0578	.879	1.0419	At quarter 1″.0600 diameter.
80,000	88,990	2.330	1.0456	1.0702	.899	1.0469	
85,000	92,090	2.278	1.0532	1.0844	.923	1.0562	
90,000	95,740	2.218	1.0602	1.0978	.946	1.0627	At quarter 1″.1050 diameter.
95,000	97,640	2.161	1.0722	1.1131	.973	1.0744	
100,000	100,400	2.112	1.0786	1.1260	.996	1.0814	
110,000	103,680	1.995	1.0985	1.1624	1.061	1.1010	
120,000	105,170	1.865	1.1195	1.2056	1.141	1.1218	At quarter 1″.2144 diameter.
130,000	100,000	1.743	1.1428	1.2513	1.300	1.1578	
140,000	106,060	1.634	1.1720	1.2965	1.320	1.1760	
150,000	106,610	1.534	1.203	1.3385	1.407	1.202	
160,000	107,100	1.460	1.225	1.379	1.494	1.225	
170,000	106,920	1.382	1.251	1.423	1.590	1.250	
The quarter-inch sections scored on cylindrical surface now measure as follows: ″.086, ″.164, ″.160, ″.154, ″.145, ″.144, ″.152, ″.152, ″.156, ″.088.							
180,000	107,660	1.317	1.280	1.459	1.672	1.277	
190,000	107,220	1.255	1.308	1.502	1.772	1.308	Middle diameter now the maximum one. Seven minute longitudinal cracks opened ″.05 to ″.08 long.
200,000	108,340	1.201	1.341	1.533	1.846	1.332	
210,000	108,750	1.153	1.368	1.568	1.931	1.360	
220,000	110,220	1.112	1.395	1.594	1.996	1.383	
240,000	112,150	1.044	1.452	1.654	2.149	1.435	
The quarter-inch sections scored on the cylindrical surface now measure as follows: ″.00, ″.135, ″.144, ″.134, ″.125, ″.122, ″.132, ″.134, ″.138, ″.00.							
260,000	114,130	.980	1.510	1.703	2.278	1.480	
280,000	115,610	.932	1.562	1.756	2.422	1.526	
300,000	117,370	.880	1.610	1.804	2.556	1.580	

Opened an oblique shearing fracture 49° with axis of specimen.

The quarter-inch sections now measure as follows: ″.00, ″.076, ″.125, ″.125, ″.116, ″.117, ″.126, ″.135, ″.076, ″.00.

No. 922.

Rail No. 26.

Length, 4″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 3″.

Applied loads.		In gauged lengths.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4,000	5,000	.0003	.....	
8,000	10,000	.0007	.....	
12,000	15,000	.0012	.....	
16,000	20,000	.0017	.....	
20,000	25,000	.0022	.....	
24,000	30,000	.0027	0.	
28,000	35,000	.0032	.....	
30,400	38,000	.0034	.....	
31,200	39,000	.0035	.....	Elastic limit.
32,000	40,000	.0039	.0003	
32,800	41,000	.0290	.....	
33,600	42,000	.0333	.....	
34,400	43,000	.0374	.....	
35,200	44,000	.0411	.....	
36,000	45,000	.0455	.0411	
36,800	46,000	.0478	.....	
37,600	47,000	.0529	.....	
38,400	48,000	.0564	.....	
39,200	49,000	.0611	.....	
40,000	50,000	.0654	.0606	
41,600	52,000	.0742	.....	
43,200	54,000	.0838	.....	
44,800	56,000	.0942	.....	
46,400	58,000	.1045	.....	
48,000	60,000	.1150	.1091	

Specimen cut off, reducing its length to 2″.505. Rested 12 days and loading resumed.

No. 922—Continued.

Applied loads.		Length.	Diameters.				Remarks.
			End A.	Middle.		End B.	
Total.	Per square inch.			Diamter.	Sectional area.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	*Sq. Inches.*	*Inches.*	
0	0	2.505	1.0253	1.0278	.829	1.0276	
55,000	65,480	2.476	1.0261	1.0341	.840	1.0297	
60,000	70,180	2.437	1.0312	1.0433	.855	1.0328	
65,000	74,460	2.392	1.0372	1.0542	.873	1.0382	
70,000	78,380	2.337	1.0436	1.0665	.893	1.0445	
75,000	81,430	2.276	1.0525	1.0832	.921	1.0526	
80,000	83,420	2.172	1.0742	1.1052	.959	1.0672	
85,000	85,860	2.113	1.087	1.1230	.990	1.080	
90,000	88,150	2.051	1.097	1.1402	1.021	1.090	At quarter 1″.1465 diam.
95,000	89,870	1.981	1.111	1.1600	1.057	1.101	
100,000	87,180	1.914	1.126	1.2088	1.147	1.113	Rested without load 24 hours.
110,000	93,060	1.796	1.154	1.227	1.182	1.133	
120,000	94,340	1.674	1.176	1.273	1.272	1.165	
130,000	95,100	1.570	1.208	1.319	1.367	1.192	
140,000	95,690	1.482	1.223	1.365	1.463	1.212	
150,000	95,780	1.405	1.262	1.412	1.566	1.254	
160,000	96,620	1.331	1.287	1.452	1.656	1.274	
170,000	97,760	1.268	1.323	1.488	1.739	1.310	
180,000	97,140	1.203	1.348	1.536	1.853	1.334	
190,000	98,660	1.148	1.380	1.566	1.926	1.360	
200,000	98,860	1.111	1.416	1.605	2.023	1.400	
210,000	100,910	1.066	1.438	1.628	2.081	1.424	
220,000	101,150	1.026	1.470	1.664	2.175	1.456	
240,000	100,670	.960	1.516	1.716	2.384	1.500	
260,000	106,510	.905	1.578	1.763	2.441	1.550	
280,000	108,820	.863	1.615	1.810	2.573	1.590	
300,000	110,780	.824	1.690	1.857	2.708	1.650	

A cluster of very fine longitudinal cracks was developed in one locality during the test, and when near the close three fine oblique cracks opened ″.08 to ″.15 long.

No throbs felt during the test.

No. 923.

Rail No. 27.

Length, 4″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4,000	5,000	.0005	.....	
8,000	10,000	.0012	.....	
12,000	15,000	.0017	.....	
16,000	20,000	.0022	.....	
20,000	25,000	.0027	.....	
24,000	30,000	.0032	0.	
28,000	35,000	.0037	0.	
28,800	36,000	.0037	.....	
29,600	37,000	.0038	.....	
30,400	38,000	.0038	.....	
31,200	39,000	.0040	.....	
32,000	40,000	.0041	.0002	
32,800	41,000	.0043	.....	
33,600	42,000	.0045	.....	Elastic limit.
34,400	43,000	.0048	.....	
35,200	44,000	.0055	.....	
36,000	45,000	.0073	.0035	
36,800	46,000	.0092	.....	
37,600	47,000	.0147	.....	
38,400	48,000	.0170	.....	
39,200	49,000	.0221	.....	
40,000	50,000	.0253	.0206	
41,600	52,000	.0321	.....	
43,200	54,000	.0392	.....	
44,800	56,000	.0448	.....	
46,400	58,000	.0526	.....	
48,000	60,000	.0603	.0553	
49,600	62,000	.0670	.....	
51,200	64,000	.0756	.....	
52,800	66,000	.0846	.....	
54,400	68,000	.0919	.....	
56,000	70,000	.1042	.0980	

Specimen cut off, reducing length to 2″.504. Rested without load 12 days, test then resumed.

No. 27 No. 30.

No. 923—Continued.

Applied loads.		Length.	Diameters.				Remarks.
			End A.	Middle.		End B.	
Total.	Per square inch.			Diameter.	Sectional area.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Inches.*	
0	0	2.504	1.0246	1.0238	.823	1.0232	
65,000	77,380	2.465	1.0278	1.0346	.840	1.0262	
70,000	81,960	2.430	1.0323	1.0427	.854	1.0296	
75,000	86,600	2.392	1.0366	1.0505	.866	1.0330	
80,000	90,090	2.342	1.0436	1.0633	.888	1.0406	
85,000	93,510	2.291	1.0487	1.0762	.909	1.0462	
90,000	96,980	2.233	1.0590	1.0872	.928	1.0533	
95,000	99,790	2.180	1.0656	1.1010	.952	1.0607	
100,000	102,140	2.120	1.0746	1.1165	.979	1.0688	At quarters 1″.1252 diameter.
110,000	104,960	2.003	1.0914	1.1555	1.048	1.0818	At quarters 1″.1653 diameter.
120,000	108,010	1.892	1.113	1.189	1.111	1.097	
130,000	110,640	1.797	1.126	1.223	1.175	1.118	
140,000	112,630	1.723	1.144	1.258	1.243	1.132	
150,000	111,860	1.609	1.166	1.307	1.341	1.156	
160,000	112,520	1.526	1.188	1.345	1.422	1.180	
170,000	112,210	1.443	1.217	1.389	1.515	1.210	
180,000	108,700	1.328	1.263	1.452	1.656	1.248	
190,000	110,790	1.267	1.289	1.478	1.715	1.274	
200,000	109,950	1.215	1.322	1.522	1.819	1.308	
220,000	112,190	1.117	1.390	1.580	1.961	1.353	
240,000	112,780	1.046	1.442	1.646	2.128	1.400	
260,000	114,080	.976	.....	1.704	2.279	1.472	
280,000	117,200	.938	.....	1.744	2.389	1.508	
300,000	120,140	.889	.....	1.783	2.497	1.560	

The cylindrical surface was divided by minute cracks extending from ″.02 to ″.05 in a longitudinal direction.

On one side four fine seams extended $\frac{1}{4}$″ to $\frac{1}{2}$″ longitudinally.

No. 924.

Rail No. 30.

Length, 4″.
Diameter, 1″.0092.
Sectional area, .80 square inch.
Gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4,000	5,000	.0006	0.	
8,000	10,000	.0012	.....	
12,000	15,000	.0017	.....	
16,000	20,000	.0023	.....	
20,000	25,000	.0028	.....	
24,000	30,000	.0033	.....	
28,000	35,000	.0038	.0001	
28,800	36,000	.0039	.....	
29,600	37,000	.0040	.....	
30,400	38,000	.0042	.....	
31,200	39,000	.0043	.....	
32,000	40,000	.0044	.0003	
32,800	41,000	.0045	.....	
33,600	42,000	.0047	.....	
34,400	43,000	.0048	.....	
35,200	44,000	.0050	.....	Elastic limit.
36,000	45,000	.0053	.0010	
36,800	46,000	.0056	.....	
37,600	47,000	.0059	.....	
38,400	48,000	.0062	.....	
39,200	49,000	.0066	.....	
40,000	50,000	.0075	.0030	
40,800	51,000	.0084	.....	
41,600	52,000	.0097	.....	
42,400	53,000	.0104	.....	
43,200	54,000	.0119	.....	
44,000	55,000	.0133	.0080	
44,800	56,000	.0145	.....	
45,600	57,000	.0162	.....	
46,400	58,000	.0178	.....	
47,200	59,000	.0202	.....	
48,000	60,000	.0225	.0165	
49,600	62,000	.0275	.....	
51,200	64,000	.0320	.....	
52,800	66,000	.0377	.....	
54,400	68,000	.0432	.....	
56,000	70,000	.0488	.0413	
57,600	72,000	.0538	.....	
59,200	74,000	.0610	.....	
60,800	76,000	.0676	.....	
62,400	78,000	.0737	.....	
64,000	80,000	.0821	.0730	
65,600	82,000	.0878	.....	
67,200	84,000	.0950	.....	
68,800	86,000	.1040	.....	
70,400	88,000	.1167	.....	
72,000	90,000	.1253	.1150	

No. 924—Continued.

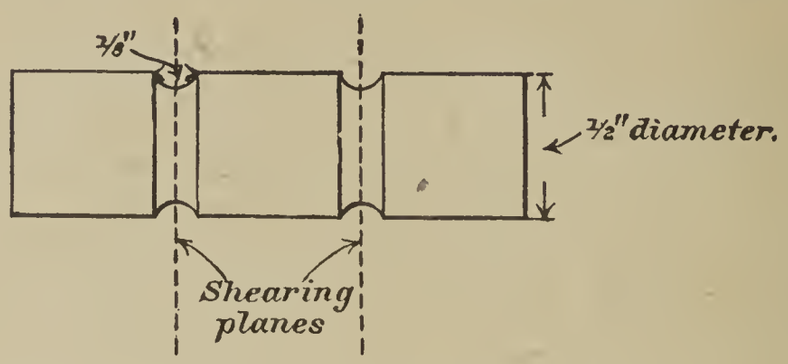
Applied loads.		Length.	Diameters.				Remarks.
			End A.	Middle.		End B.	
Total.	Per square inch.			Diameter.	Sectional area.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Inches.*	
0	0	2.457	1.0162	1.0204	.818	1.0212	
85,000	102,530	2.422	1.0187	1.0275	.829	1.0224	
90,000	106,260	2.369	1.0234	1.0381	.847	1.0269	
95,000	109,700	2.340	1.0272	1.0499	.866	1.0306	
100,000	114,020	2.296	1.0322	1.0565	.877	1.0350	
110,000	119,560	2.196	1.041	1.0820	.920	1.046	
120,000	122,080	2.076	1.060	1.1184	.983	1.060	At quarter 1″.1275 diam.
130,000	124,880	1.973	1.080	1.1514	1.041	1.077	
140,000	129,390	1.870	1.096	1.174	1.082	1.107	End B was greased.
150,000	129,870	1.771	1.112	1.213	1.155	1.126	Piece of paper over end B.
160,000	132,230	1.687	1.126	1.241	1.210	1.142	At quarter 1″.266 diam.
170,000	132,500	1.605	1.145	1.278	1.283	1.168	
180,000	132,940	1.535	1.168	1.313	1.354	1.185	
190,000	133,520	1.459	1.184	1.346	1.423	1.201	
200,000	132,360	1.391	1.213	1.387	1.511	1.221	
210,000	131,330	1,323	1.249	1.427	1.599	1.245	Middle diameter now the largest.
220,000	128,810	1.250	.....	1.475	1.708	.....	
230,000	.....	1.184	.....	.....	.....	.....	
240,000	.....	1.133	.....	.....	.....	.....	
260.000	.....	1.026	.....	.....	.....	.....	

Eight longitudinal belts of short oblique shearing fractures were developed. They were first conspicuous on the surface of the specimen after 16,000 pounds compression had been applied, then appearing to the eye as dark-colored belts, the lines of fracture being distinguishable by means of a reading lens.

After higher stresses were applied, these minute fractures enlarged, and after 200,000 pounds one principal fracture extended obliquely nearly the length of the specimen.

Continuing the loads, three principal fractures were enlarged, two of which extended the length of the specimen, the third nearly so.

SHEARING TESTS OF SPECIMENS FROM HEADS OF STEEL RAILS TAKEN FROM FRACTURED TENSILE SPECIMENS.



Three-eighths inch diameter at bottom of grooves.
Sheared along two planes.

No. of test.	No. of rail.	Diameter sheared.	Shearing area.	Shearing strength.		Remarks.
				Total.	Per square inch.	
		Inch.	*Sq. Inch.*	*Pounds.*	*Pounds.*	
5340	8	3/8	.22	14,620	66,450	
5341	10	3/8	.22	17,340	78,820	
5342	12	3/8	.22	17,780	80,820	
5343	17	3/8	.22	17,190	78,140	
5344	19	3/8	.22	15,330	69,680	
5345	23	3/8	.22	17,310	78,680	
5346	23	3/8	.22	17,520	79,640	Annealed.
5347	28	3/8	.22	12,490	56,770	
5348	31	3/8	.22	14,270	64,860	
5349	34	3/8	.22	13,640	62,000	
5350	36	3/8	.22	16,980	77,180	
5351	6	3/8	.22	15,530	70,590	
5352	11	3/8	.22	17,780	80,820	
5353	13	3/8	.22	18,580	84,450	
5354	17	3/8	.22	15,820	71,910	
5355	19	3/8	.22	15,810	71,860	
5356	22	3/8	.22	15,690	71,320	
5357	16	3/8	.22	18,850	85,680	
5359	1	3/8	.22	14,105	64,110	
5360	2	3/8	.22	15,030	68,320	
5361	5	3/8	.22	15,390	69,950	

RIVETED JOINTS.

Comprised in the present report are 113 tests made with steel plates of $\frac{1}{4}''$, $\frac{5}{16}''$, $\frac{3}{8}''$, and $\frac{7}{16}''$ thickness, with iron rivets, machine driven, in drilled or punched holes.

The plates used were from material used in earlier tests, the results of which have been published in previous reports.

The sheet number, showing from what sheet each plate came, and the number of the riveted joint test in which the plate had been previously tested, are shown on the sketch of each joint.

In reports of tests for the years 1885 and 1886 will be found the drawings of the sheets and the original tests referred to.

In the use of metal once before tested, such plates were selected as had not been overstrained previously, or those in which the elastic limit had been but very slightly exceeded.

The present tests are supplementary to those of earlier reports, and occupy a place intermediate between the elementary forms of joints and the more elaborate types of joints which have been investigated.

Wide variation has been given the pitches, and rivets of extreme diameters have been used for the purpose of including joints in which these features have been carried to their practical limits.

In double-riveted seams chain and zigzag riveting have been employed, and their relative behavior ascertained when the distance between rows of rivets was reduced.

The metal in a riveted joint frequently shows a tendency to draw down in thickness in an oblique direction behind each rivet, and it may happen that in zigzag riveting the second row of holes may be placed directly in the path of the metal thus reduced in thickness, and lines of fractures developed taking a zigzag course from one line of holes to the other, notwithstanding the aggregate length of plate fractured exceeds the net distance between rivet holes of the same row. Examples of this kind are shown in the $\frac{5}{16}''$ plate.

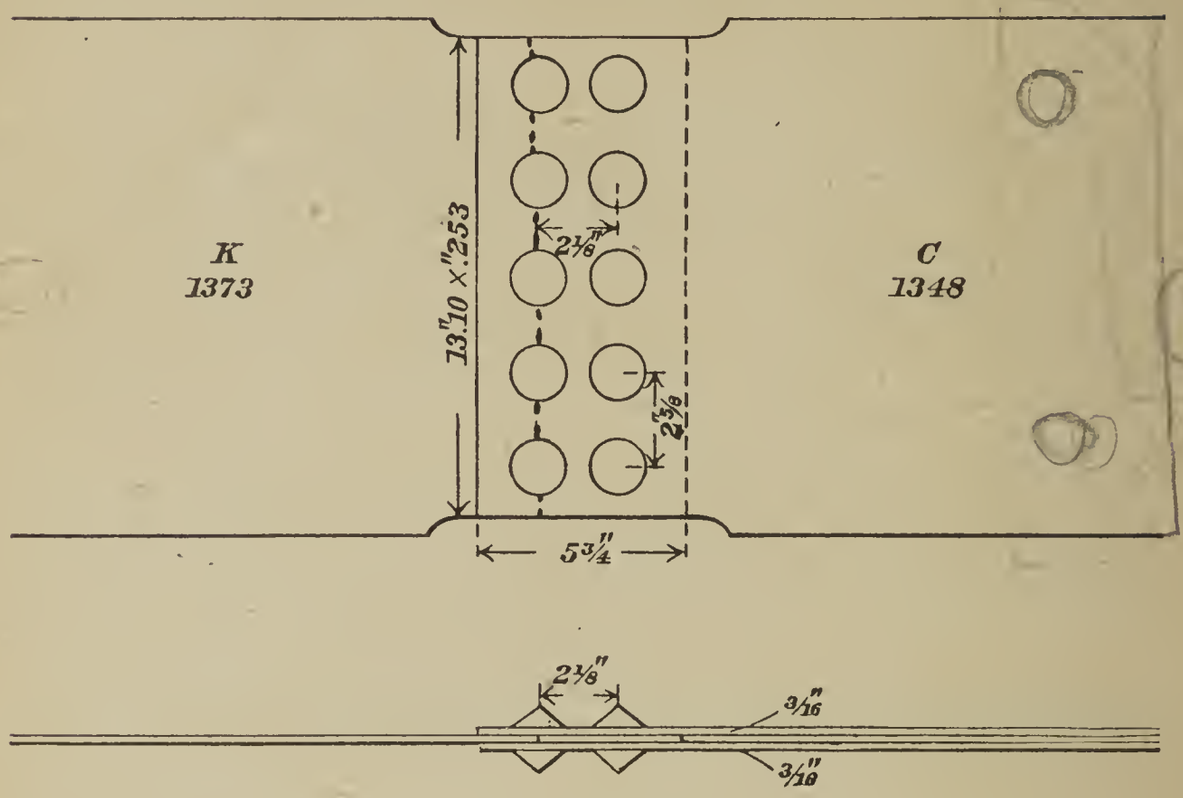
In the same thickness of plate are illustrations of chain-riveted joints of corresponding distances between rows of holes, in which the lines of fracture have taken a direct course along the seam from hole to hole in the same row.

In joint No. 4993, which has the minimum distance between rows, the net distance is $\frac{1}{2}''$, while in the direction of the pitch the net distance is $2\frac{1}{2}''$.

The efficiencies of the joints are stated in per cent of the strength of the solid plate.

No. 4911.

($\frac{1}{4}$″ steel plate; $\frac{5}{8}$″ drilled holes; iron rivets, $2\frac{5}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.31
Plate, net sectional area	do	2.52
Plate-bearing surface of rivets	do	1.58
Rivets, shearing area	do	6.14

Tensile strength, 162,500 pounds.
Fractured plate along first row of rivet holes, silky, lamellar.

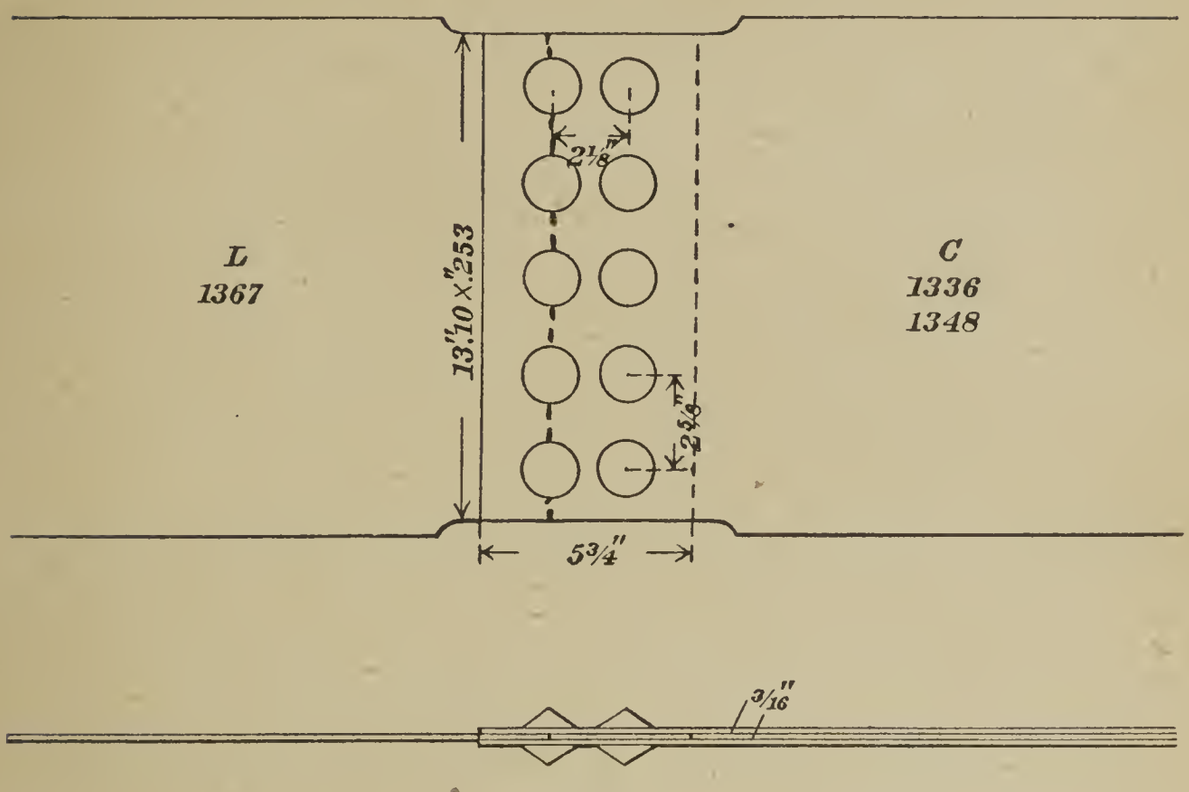
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	49,090
Tension on net section of plate	do	64,480
Compression on bearing surface of rivets	do	102,850
Shearing on rivets	do	26,470
Average elongation of rivet holes:		
First row	inch	.37
Second row	do	.05

Efficiency of joint, 84.4 per cent.

No. 4912.

($\frac{1}{4}$″ steel plate; $\frac{5}{8}$″ drilled holes; iron rivets, $2\frac{5}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.31
Plate, net sectional area	do	2.52
Plate-bearing surface of rivets	do	1.58
Rivets, shearing area	do	6.14

Tensile strength, 172,000 pounds.

Fractured plate along first row of rivet holes. Appearance silky, slightly lamellar.

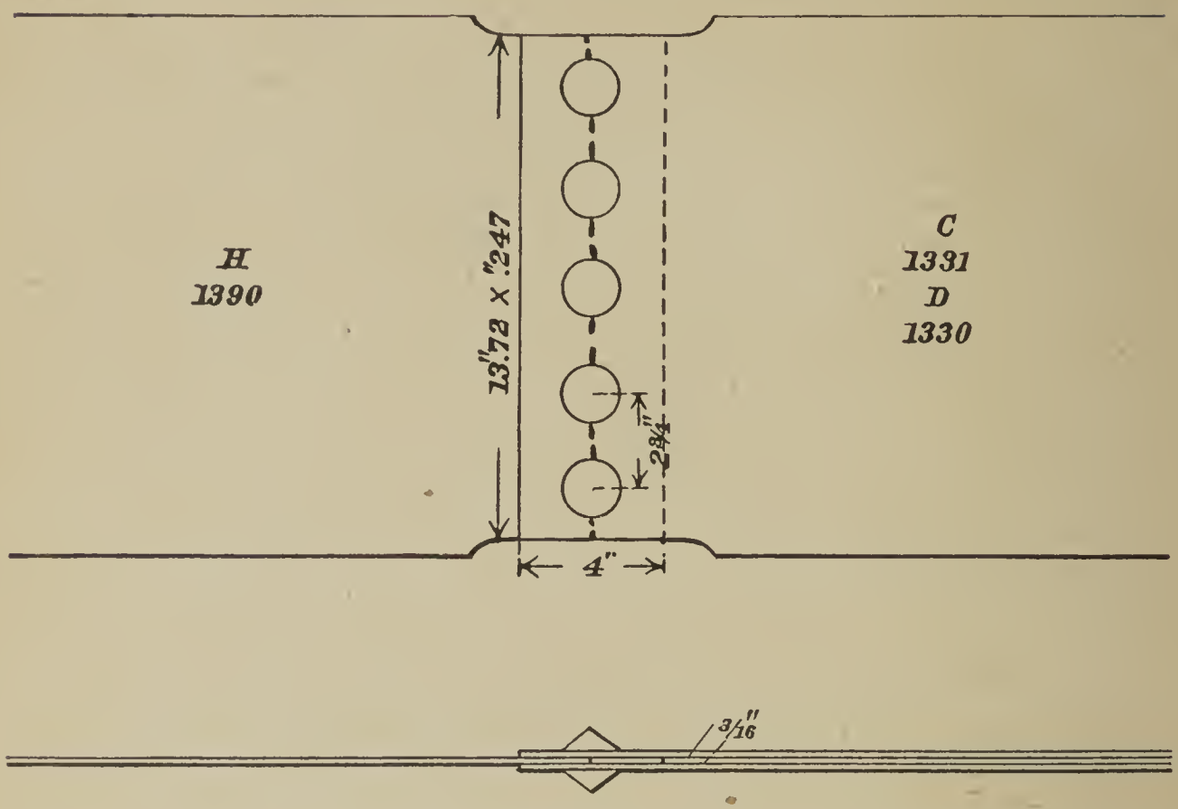
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	51,960
Tension on net section of plate	do	68,250
Compression on bearing surface of rivets	do	108,860
Shearing on rivets	do	28,010

Efficiency of joint, 84.5 per cent.

No. 4913.

($\frac{1}{4}''$ steel plate; $\frac{7}{8}''$ drilled holes; iron rivets, $2\frac{3}{4}''$ pitch.)



Areas.

Plate, gross sectional area	square inches..	3.38
Plate, net sectional area	do....	2.31
Plate-bearing surface of rivets	do....	1.08
Rivets, shearing area	do....	6.01

Tensile strength, 151,900 pounds.

Fractured plate along line of rivet holes. Appearanee silky, slightly lamellar.

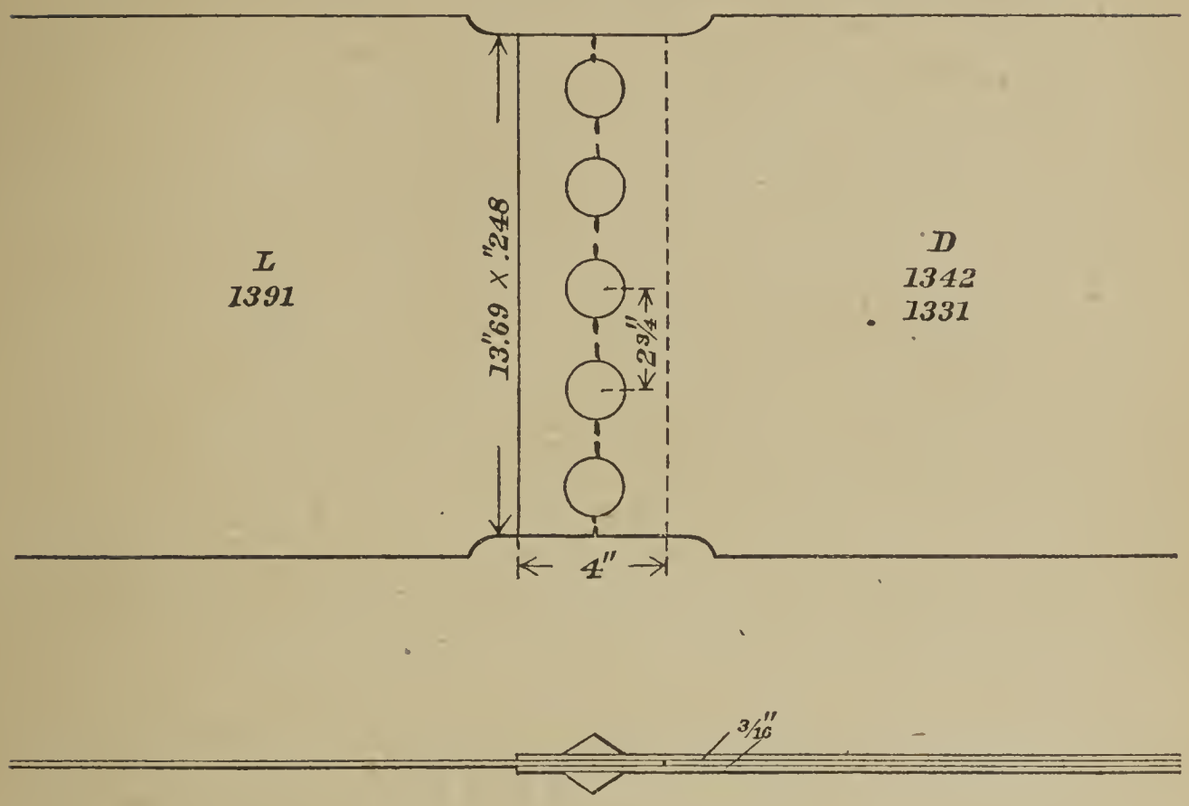
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	44,810
Tension on net section of plate	do....	65,760
Compression on bearing surface of rivets	do....	140,650
Shearing on rivets	do....	25,270

Efficiency of joint, 75.7 per cent.

No. 4914.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{3}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.40
Plate, net sectional area	do	2.31
Plate, bearing surface of rivets	do	1.09
Rivets, shearing area	do	6.01

Tensile strength, 147,900 pounds.

Fractured plate along line of rivet holes. Appearance, silky lamellar.

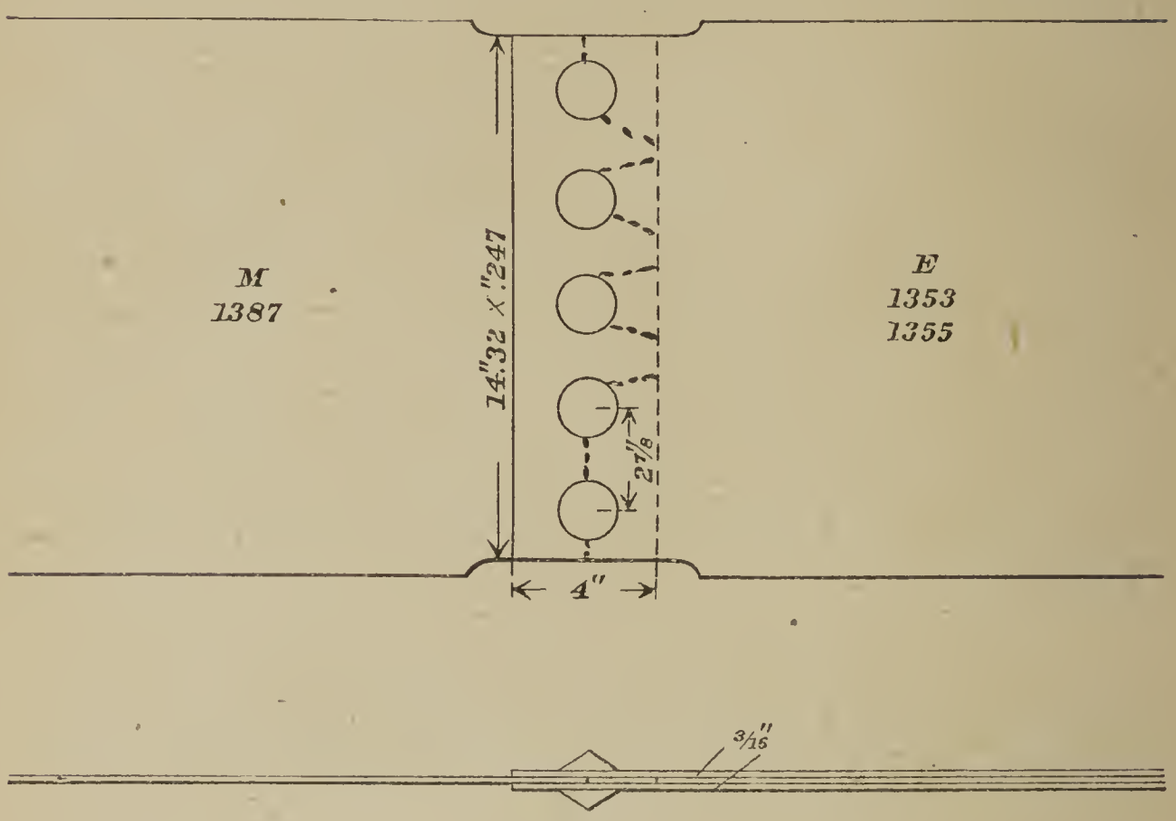
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	43,500
Tension on net section of plate	do	64,030
Compression on bearing surface of rivets	do	135,690
Shearing on rivets	do	24,610

Efficiency of joint, 70.8 per cent.

No. 4915.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.54
Plate, net sectional area	do	2.46
Plate, bearing surface of rivets	do	1.08
Rivets, shearing area	do	6.01

Tensile strength, 163,920 pounds.
Tore out plate in front of rivets.

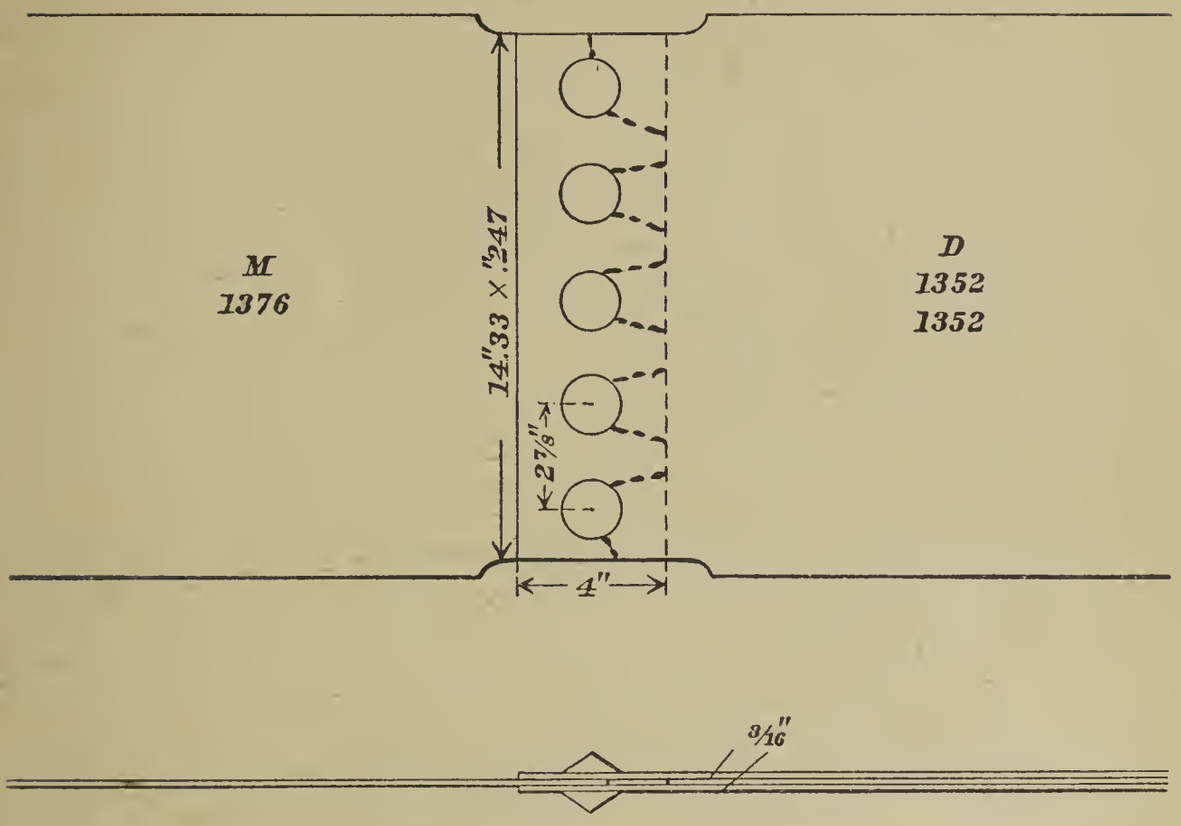
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,300
Tension on net section of plate	do	66,630
Compression on bearing surface of rivets	do	151,780
Shearing on rivets	do	27,270

Efficiency of joint, 79.6 per cent.

No. 4916.

($\frac{1}{4}''$ steel plate; $\frac{7}{8}''$ drilled holes; iron rivets, $2\frac{7}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	3.54
Plate, net sectional area	do	2.46
Plate, bearing surface of rivets	do	1.08
Rivets, shearing area	do	6.01

Tensile strength, 153,980 pounds.
Tore out plate in front of rivet holes.

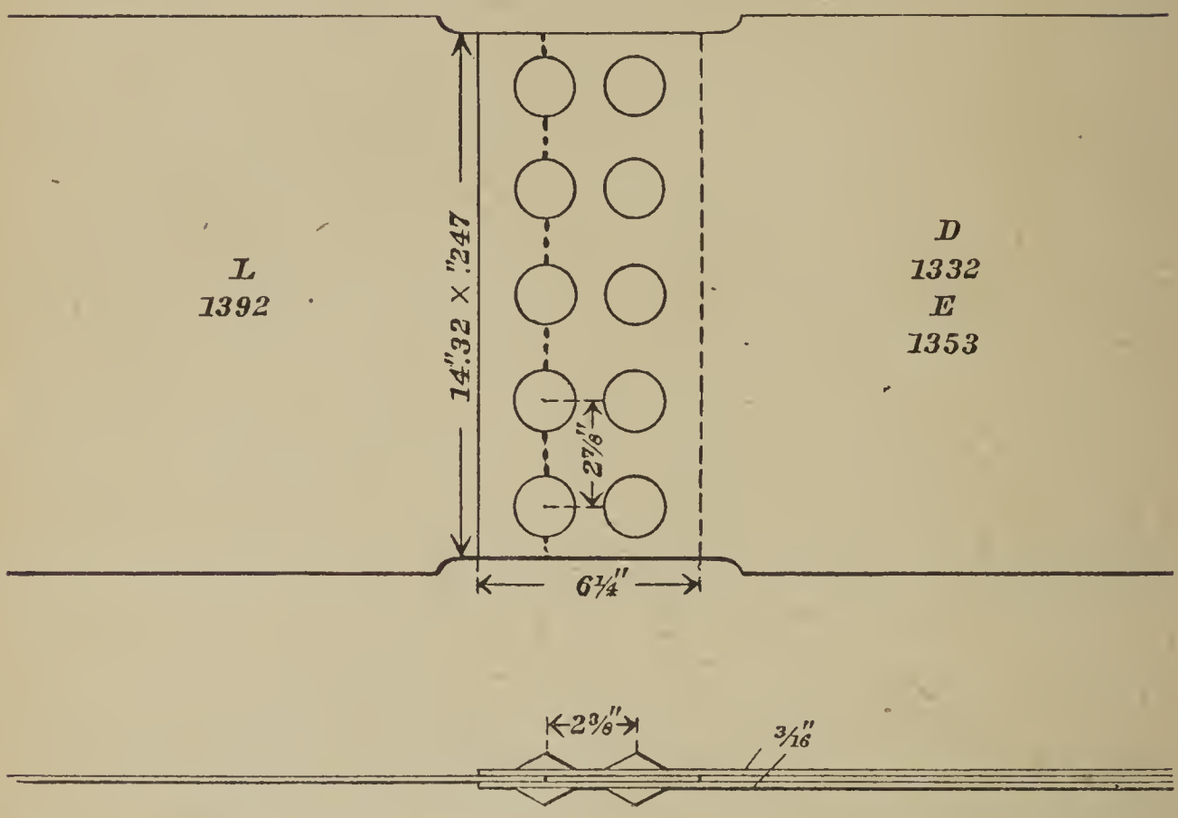
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	43,500
Tension on net section of plate	do	62,590
Compression on bearing surface of rivets	do	142,570
Shearing on rivets	do	25,620

Efficiency of joint, 74.8 per cent.

No. 4919.

($\frac{1}{4}''$ steel plate; $\frac{7}{8}''$ drilled holes; iron rivets, $2\frac{7}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	3.54
Plate, net sectional area	do	2.46
Plate, bearing surface of rivets	do	2.16
Rivets, shearing area	do	12.02

Tensile strength, 165,720 pounds.
Fractured plate along first row of rivet holes. Appearance, silky.

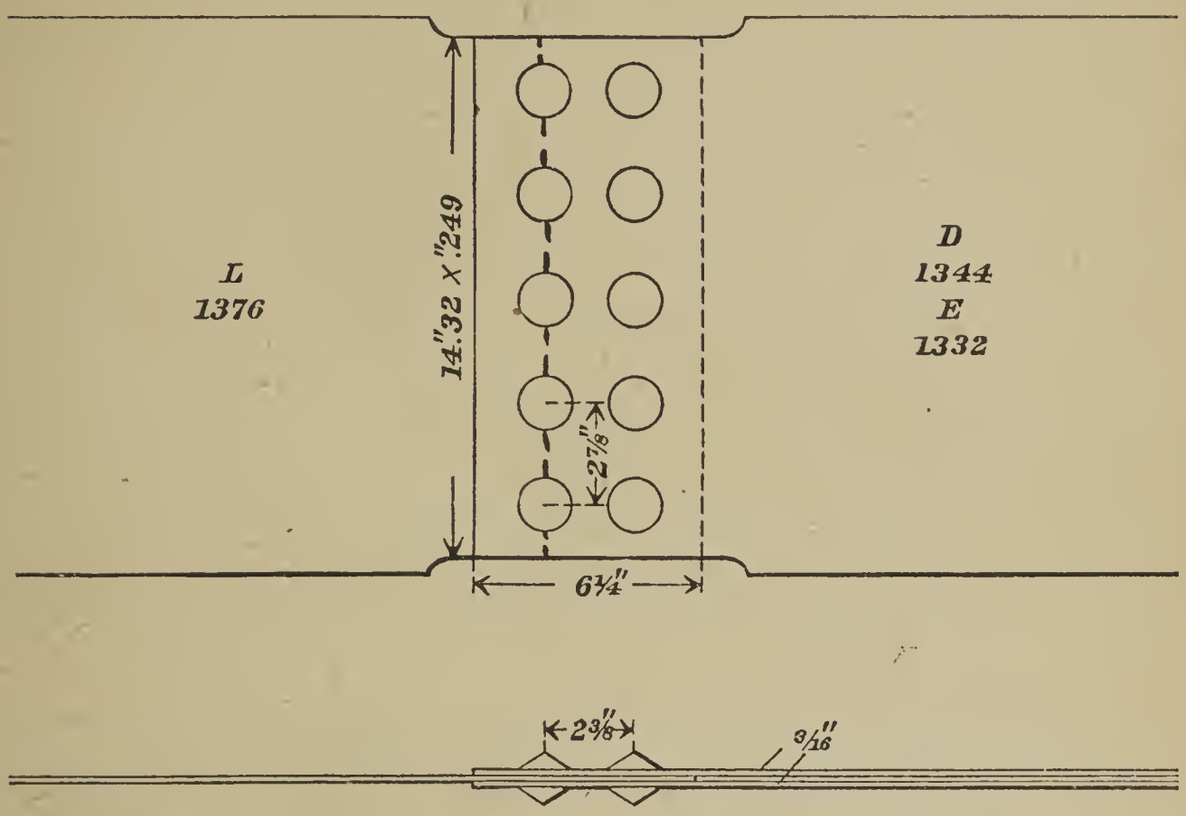
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,810
Tension on net section of plate	do	67,370
Compression on bearing surface of rivets	do	76,720
Shearing on rivets	do	13,790

Efficiency of joint, 76.1 per cent.

No. 4920.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.57
Plate, net sectional area	do	2.48
Plate, bearing surface of rivets	do	2.18
Rivets, shearing area	do	12.02

Tensile strength, 163,150 pounds.

Fractured the plate along first row of rivet holes. Appearance, silky, slightly lamellar.

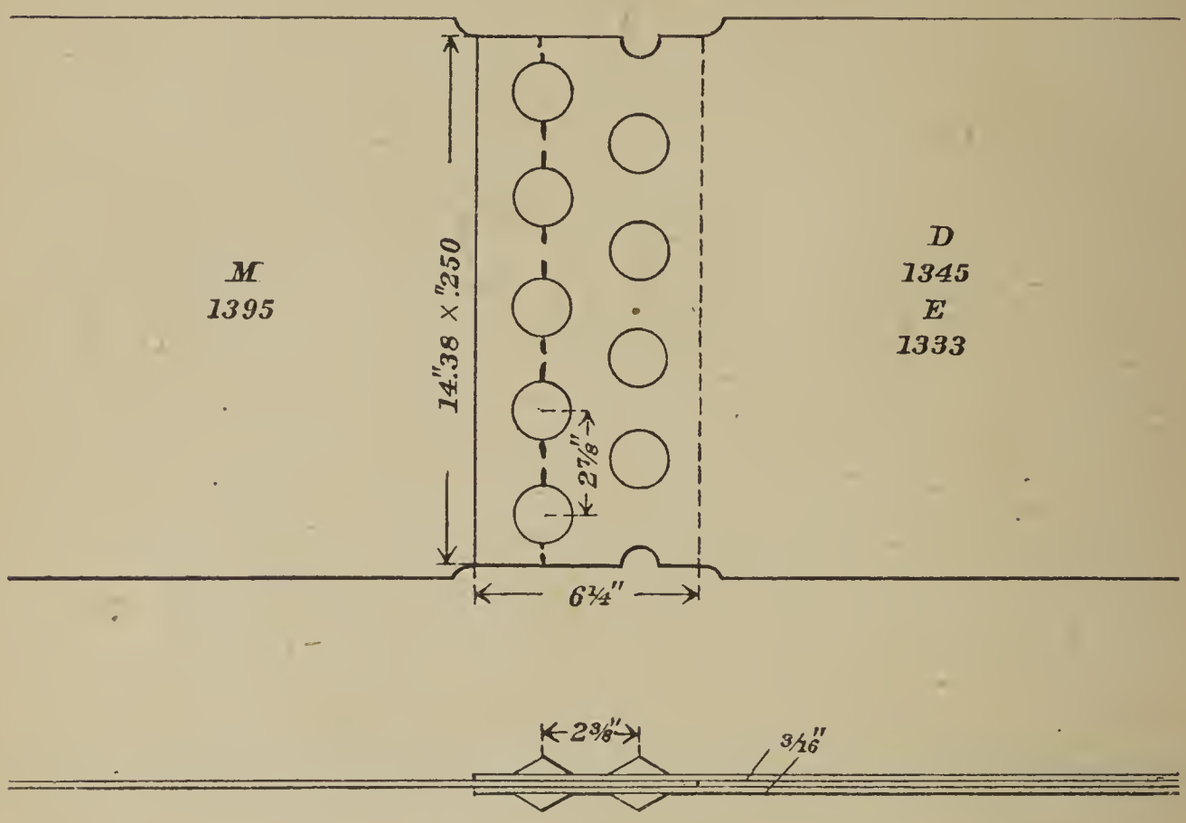
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	45,700
Tension on net section of plate	do	65,790
Compression on bearing surface of rivets	do	74,840
Shearing on rivets	do	13,570
Average elongation of rivet holes in plate:		
First row	inch	.35
Second row	do	.00

Efficiency of joint, 74.3 per cent.

No. 4927.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.59
Plate, net sectional area	do	2.50
Plate, bearing surface of rivets	do	1.97
Rivets, shearing area	do	10.82

Tensile strength, 172,850 pounds.

Fractured the plate along first row of rivet holes. Appearance, silky, slightly lamellar.

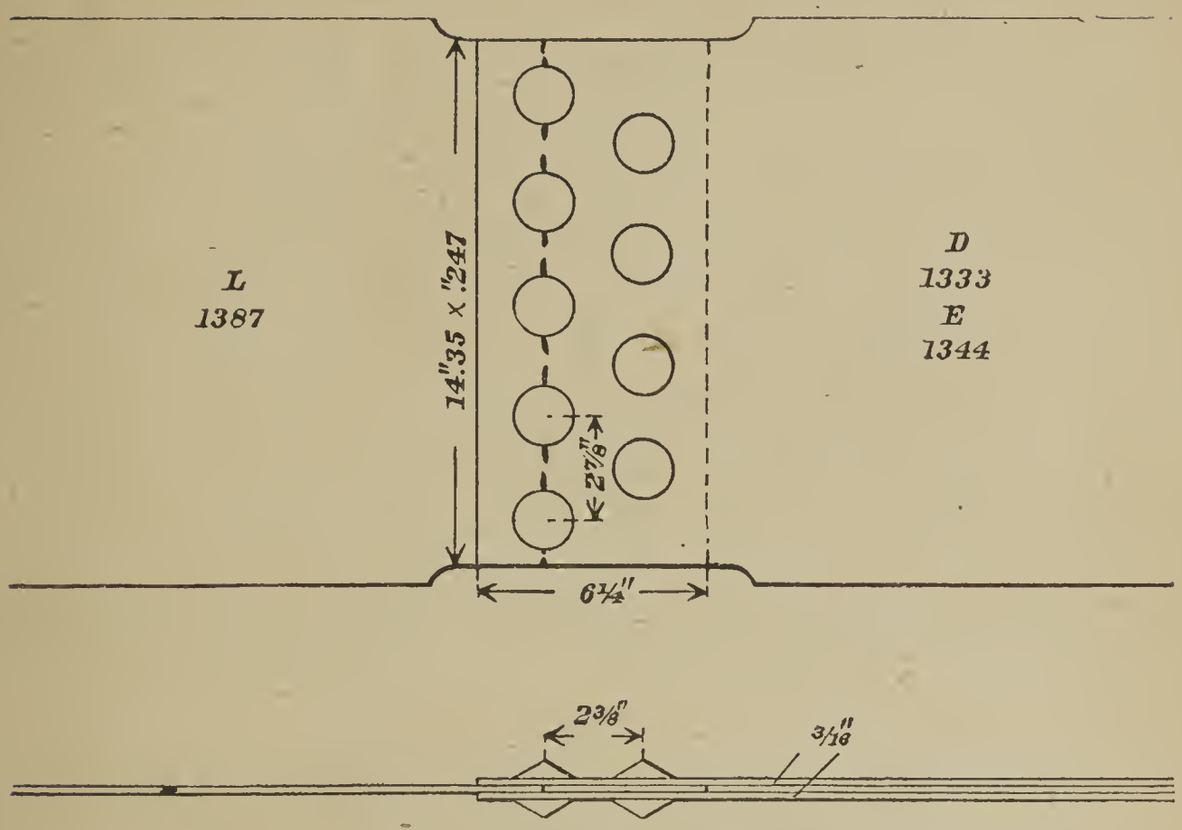
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	48,150
Tension on net section of plate	do	69,140
Compression on bearing surface of rivets	do	87,740
Shearing on rivets	do	15,980

Efficiency of joint, 80.3 per cent.

No. 4928.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.54
Plate, net sectional area	do	2.46
Plate, bearing surface of rivets	do	1.95
Rivets, shearing area	do	10.82

Tensile strength, 167,880 pounds.

Fractured plate along first row of rivet holes. Appearance, silky.

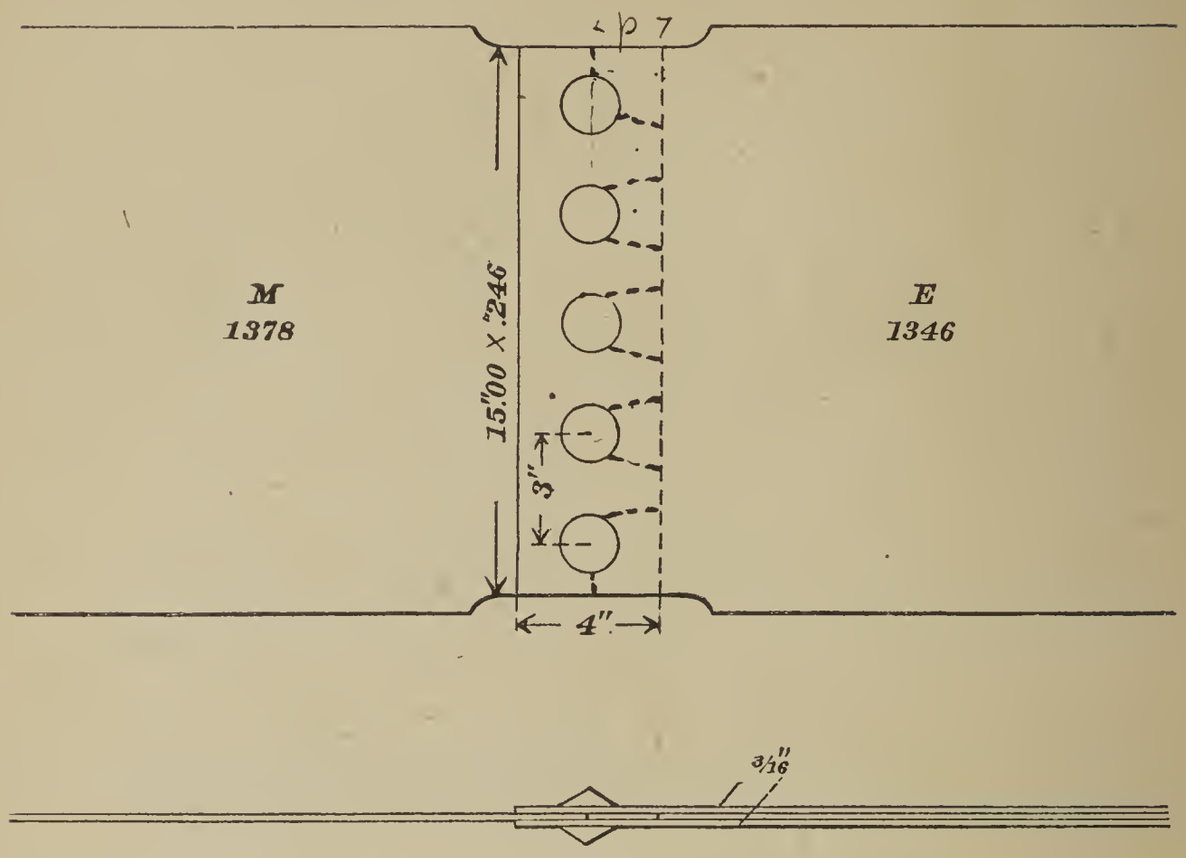
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	47,420
Tension on net section of plate	do	68,240
Compression on bearing surface of rivets	do	86,090
Shearing on rivets	do	15,520

Efficiency of joint, 77.1 per cent.

No. 4917.

($\frac{1}{4}''$ steel plate; $\frac{7}{8}''$ drilled holes; iron rivets, 3″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.69
Plate, net sectional area	do	2.61
Plate, bearing surface of rivets	do	1.08
Rivets, shearing area	do	6.01

Tensile strength, 170,800 pounds.
Tore out plate in front of rivets.

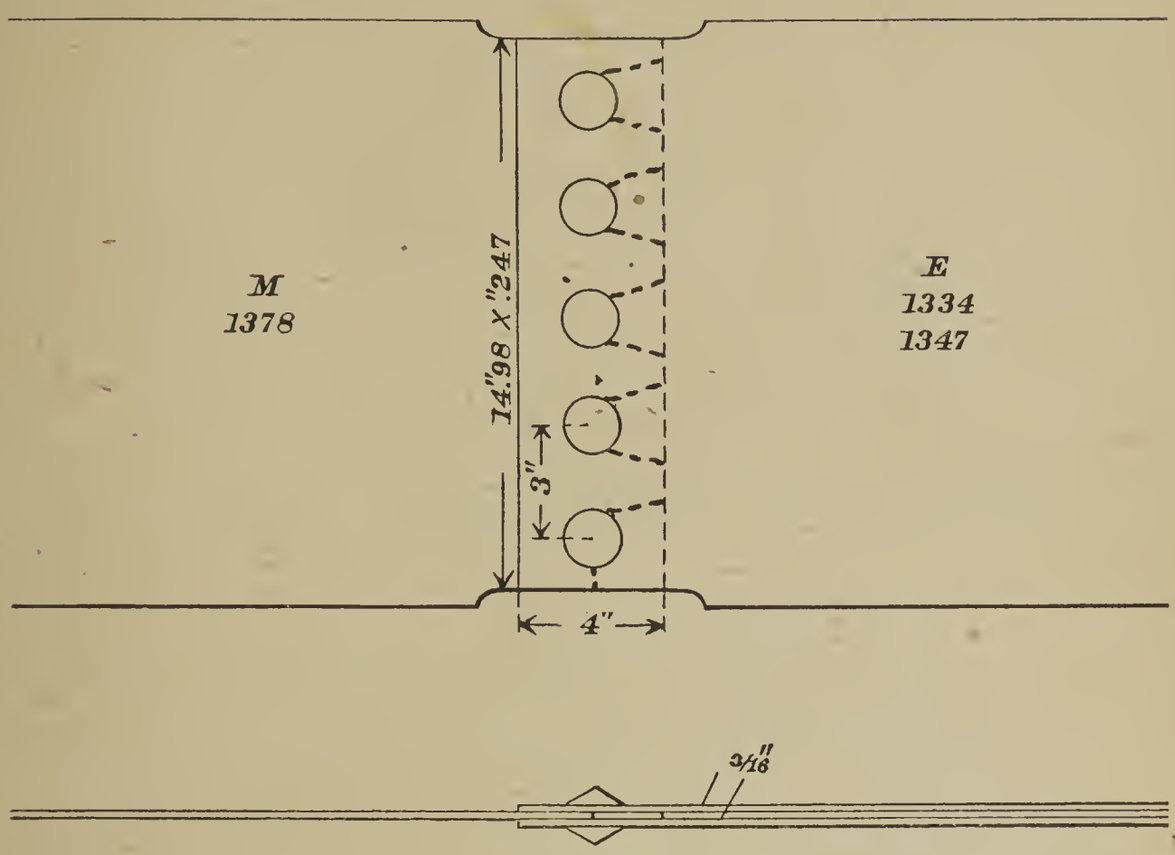
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,290
Tension on net section of plate	do	65,440
Compression on bearing surface of rivets	do	158,150
Shearing on rivets	do	28,420

Efficiency of joint, 79.6 per cent.

No. 4918.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, 3″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.70
Plate, net sectional area	do	2.62
Plate, bearing surface of rivets	do	1.08
Rivets, shearing area	do	6.01

Tensile strength, 164,280 pounds.
Tore out plate in front of rivets.

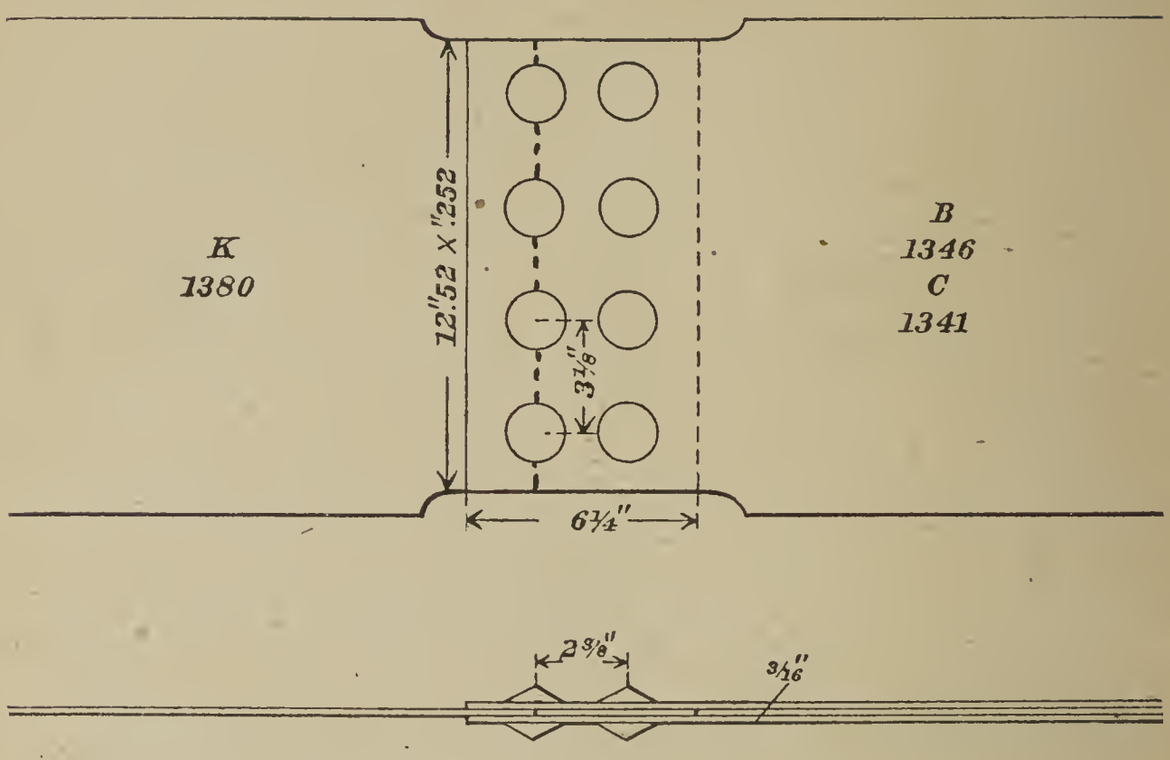
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	44,400
Tension on net section of plate	do	62,700
Compression on bearing surface of rivets	do	152,110
Shearing on rivets	do	27,330

Efficiency of joint, 76.3 per cent.

No. 4921.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $3\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.16
Plate, net sectional area	do	2.27
Plate, bearing surface of rivets	do	1.76
Rivets, shearing area	do	9.62

Tensile strength, 146,400 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, lamellar.

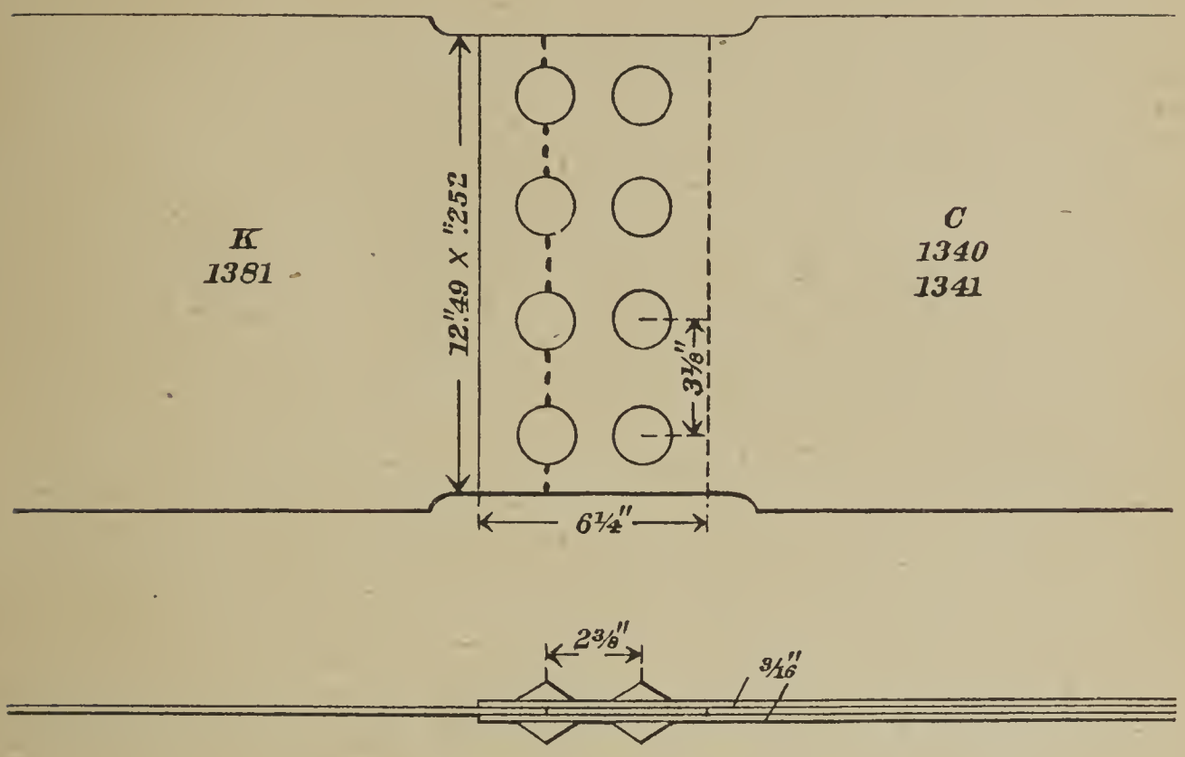
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,330
Tension on net section of plate	do	64,490
Compression on bearing surface of rivets	do	83,180
Shearing on rivets	do	15,220

Efficiency of joint, 79.6 per cent.

No. 4922.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $3\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.15
Plate, net sectional area	do	2.27
Plate, bearing surface of rivets	do	1.76
Rivets, shearing area	do	9.62

Tensile strength, 147,200 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, lamellar.

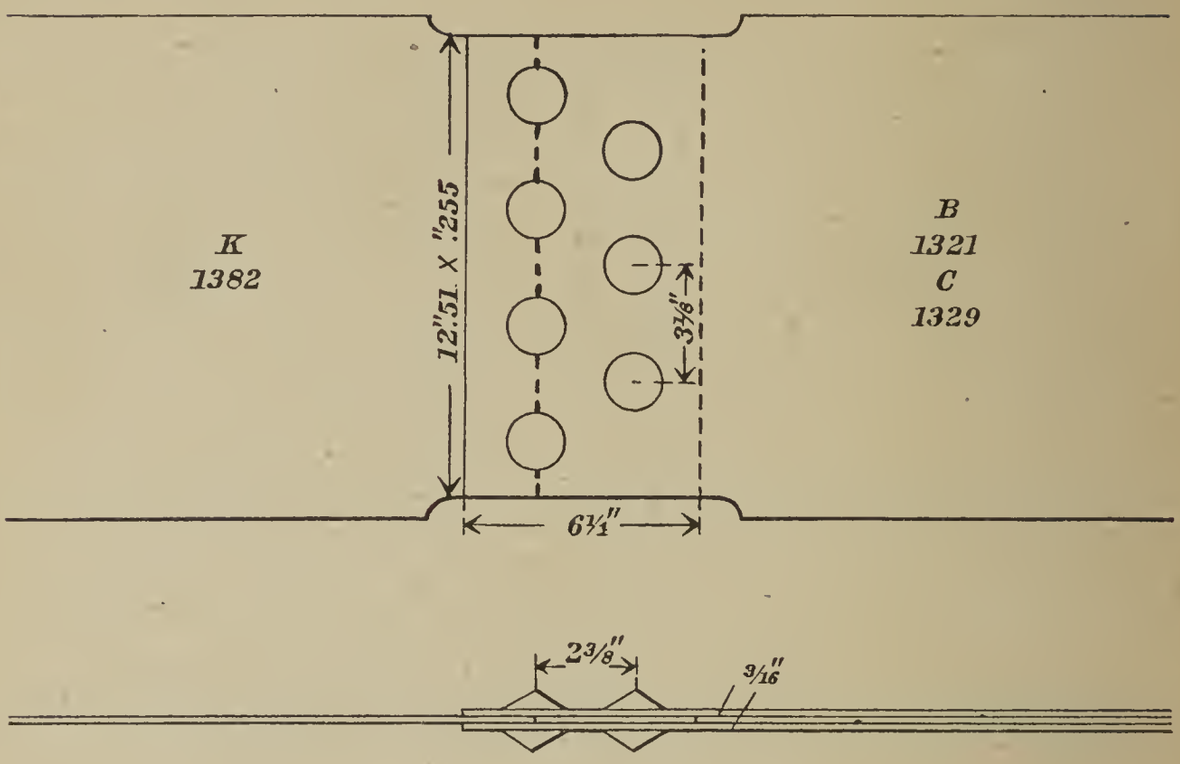
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,730
Tension on net section of plate	do	64,850
Compression on bearing surface of rivets	do	83,640
Shearing on rivets	do	15,300

Efficiency of joint, 80.3 per cent.

No. 4929.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $3\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.19
Plate, net sectional area	do	2.30
Plate, bearing sectional area	do	1.56
Rivets, shearing area	do	8.41

Tensile strength, 148,700 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, lamellar.

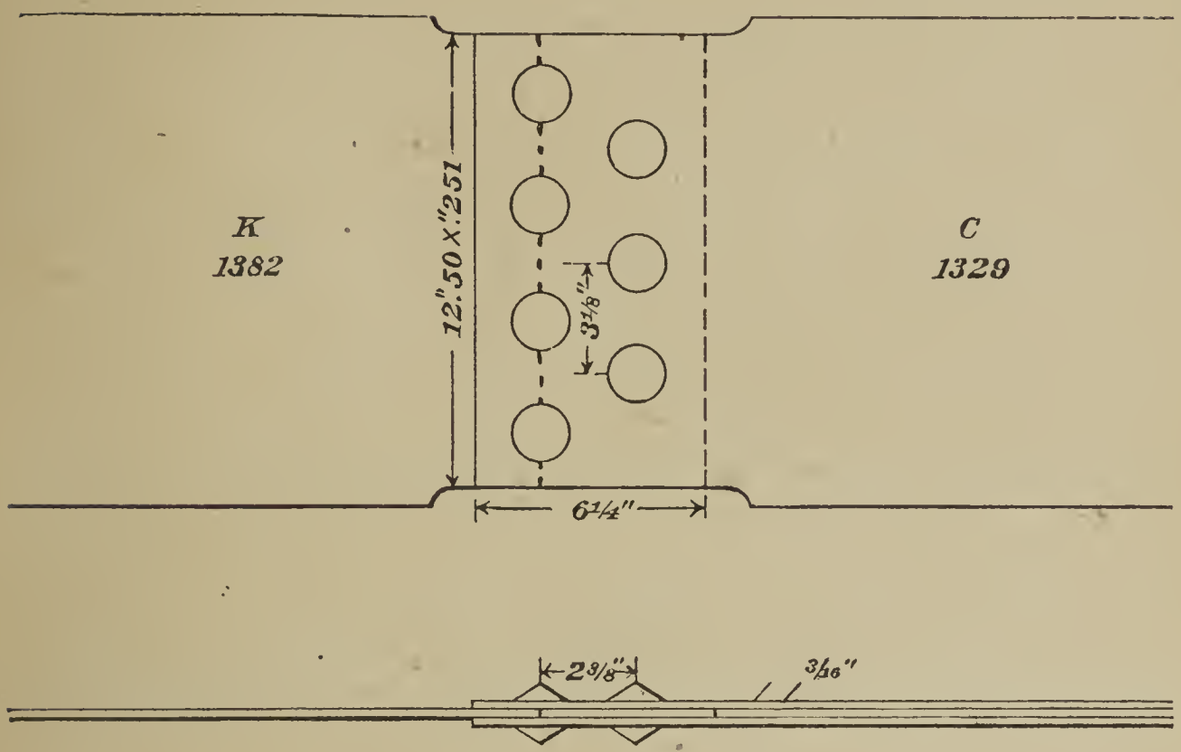
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,610
Tension on net section of plate	do	64,650
Compression on bearing surface of rivets	do	95,320
Shearing on rivets	do	17,680

Efficiency of joint, 80.2 per cent.

No. 4930.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $3\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.14
Plate, net sectional area	do	2.26
Plate, bearing surface of rivets	do	1.56
Rivets, shearing area	do	8.41

Tensile strength, 149,200 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, slightly lamellar.

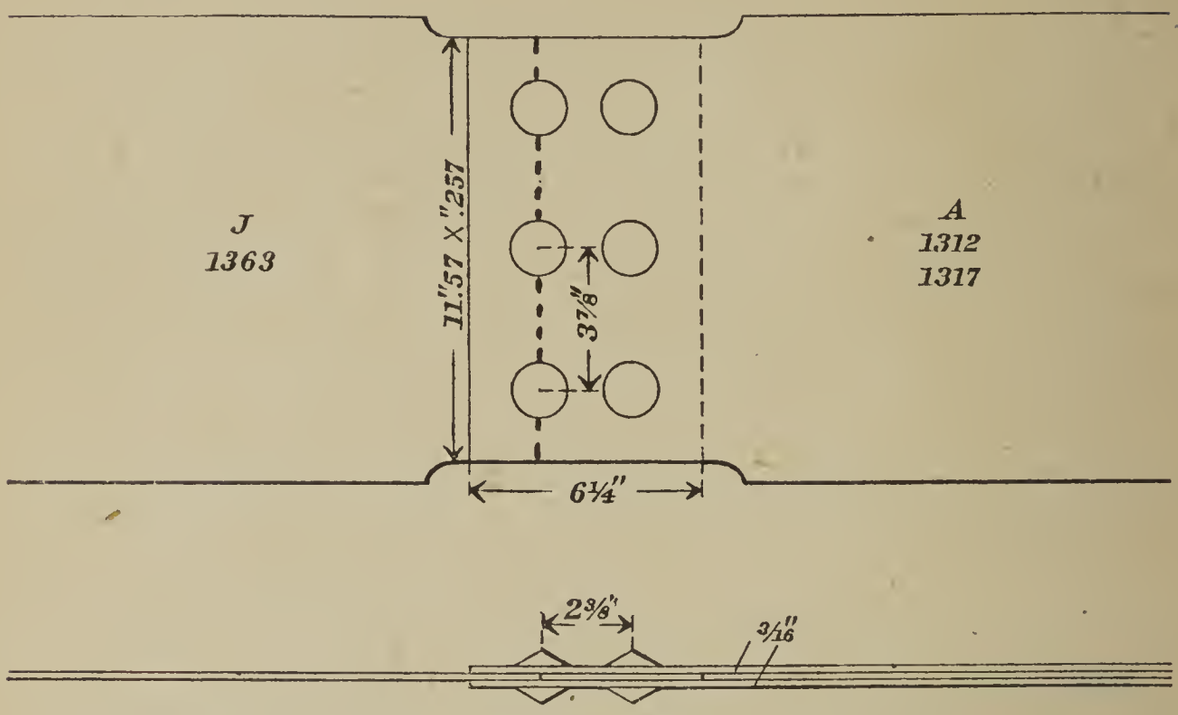
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	47,520
Tension on net section of plate	do	66,020
Compression on bearing surface of rivets	do	95,640
Shearing on rivets	do	17,740

Efficiency of joint, 81.7 per cent.

No. 4923.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $3\frac{7}{8}$″ pitch.)



Areas.

Plate, gross seetional area	square inches	2.97
Plate, net sectional area	do	2.30
Plate, bearing surfaee of rivets	do	1.35
Rivets, shearing area	do	7.21

Tensile strength, 147,060 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, slightly lamellar.

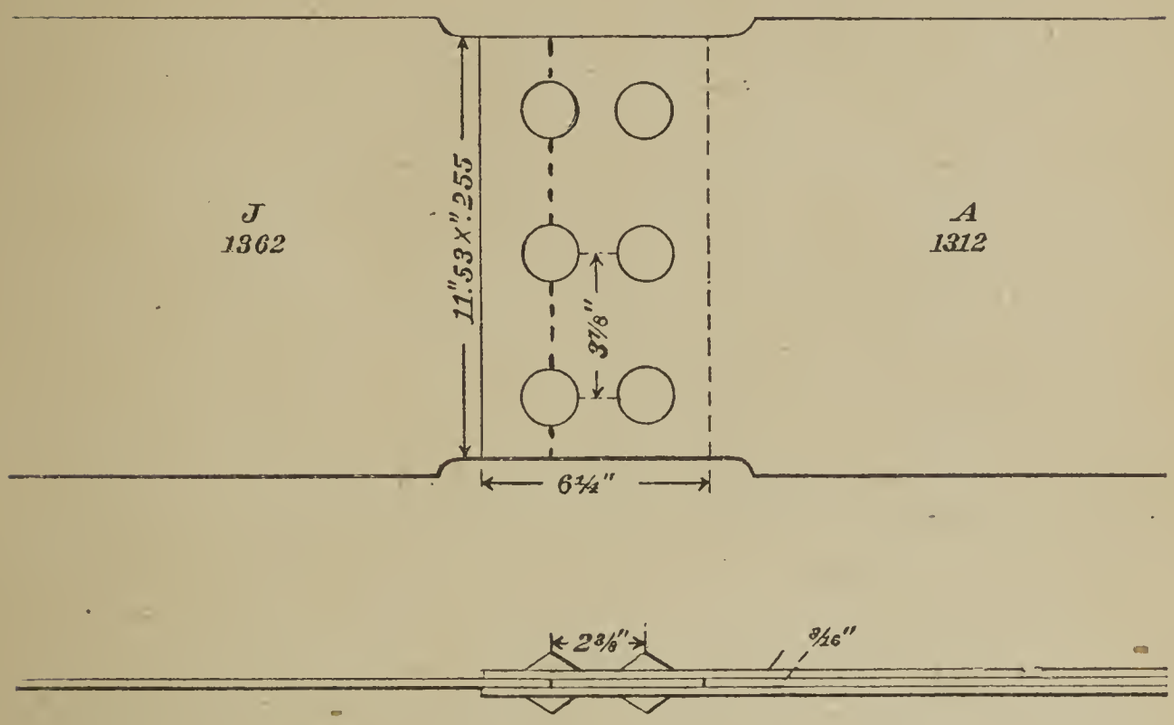
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	49,520
Tension on net seetion of plate	do	63,940
Compression on bearing surfaee of rivets	do	108,930
Shearing on rivets	do	20,400

Efficiency of joint, 81.2 per cent.

No. 4924.

($\frac{1}{4}''$ steel plate; $\frac{7}{8}''$ drilled holes; iron rivets, $3\frac{7}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	2.94
Plate, net sectional area	do	2.27
Plate, bearing surface of rivets	do	1.34
Rivets, shearing area	do	7.21

Tensile strength, 145,400 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, slightly lamellar.

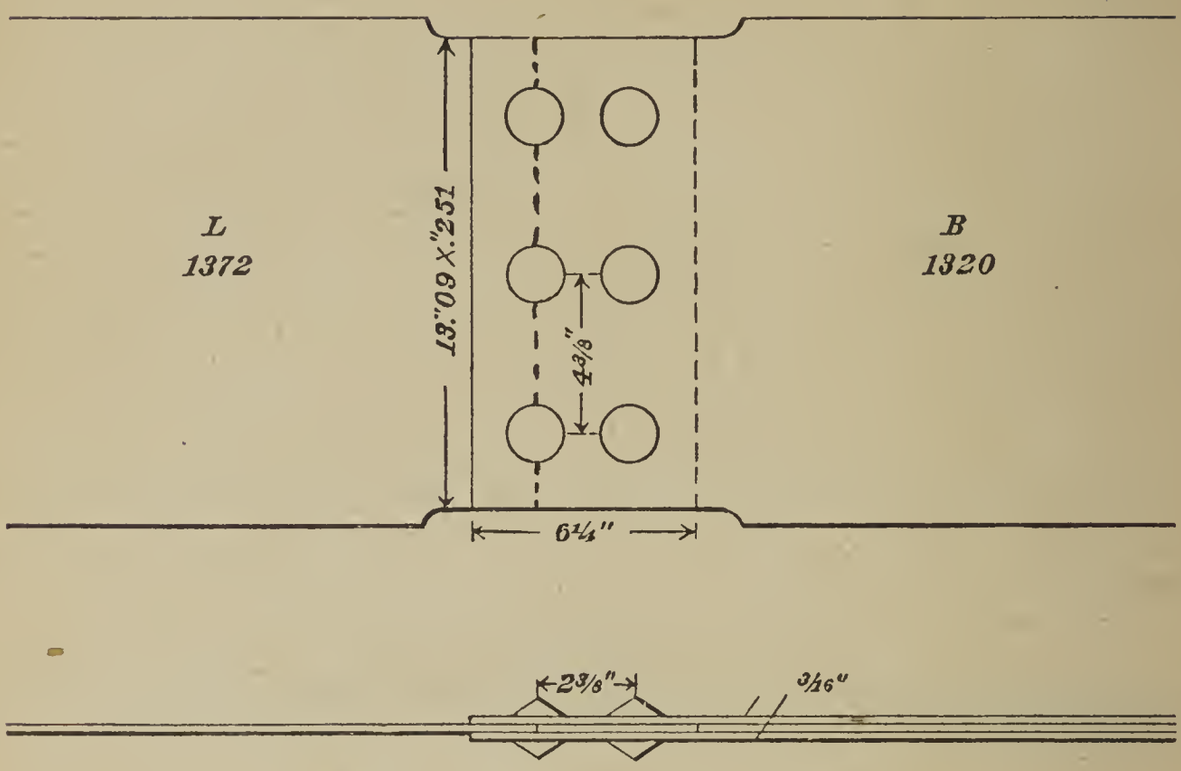
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	49,460
Tension on net section of plate	do	64,050
Compression on bearing surface of rivets	do	108,510
Shearing on rivets	do	20,170

Efficiency of joint, 81.1 per cent.

No. 4925.

($\frac{1}{4}''$ steel plate; $\frac{7}{8}''$ drilled holes; iron rivets, $4\frac{3}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	3.29
Plate, net sectional area	do	2.63
Plate, bearing surface of rivets	do	1.32
Rivets, shearing area	do	7.21

Tensile strength, 169,240 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, lamellar.

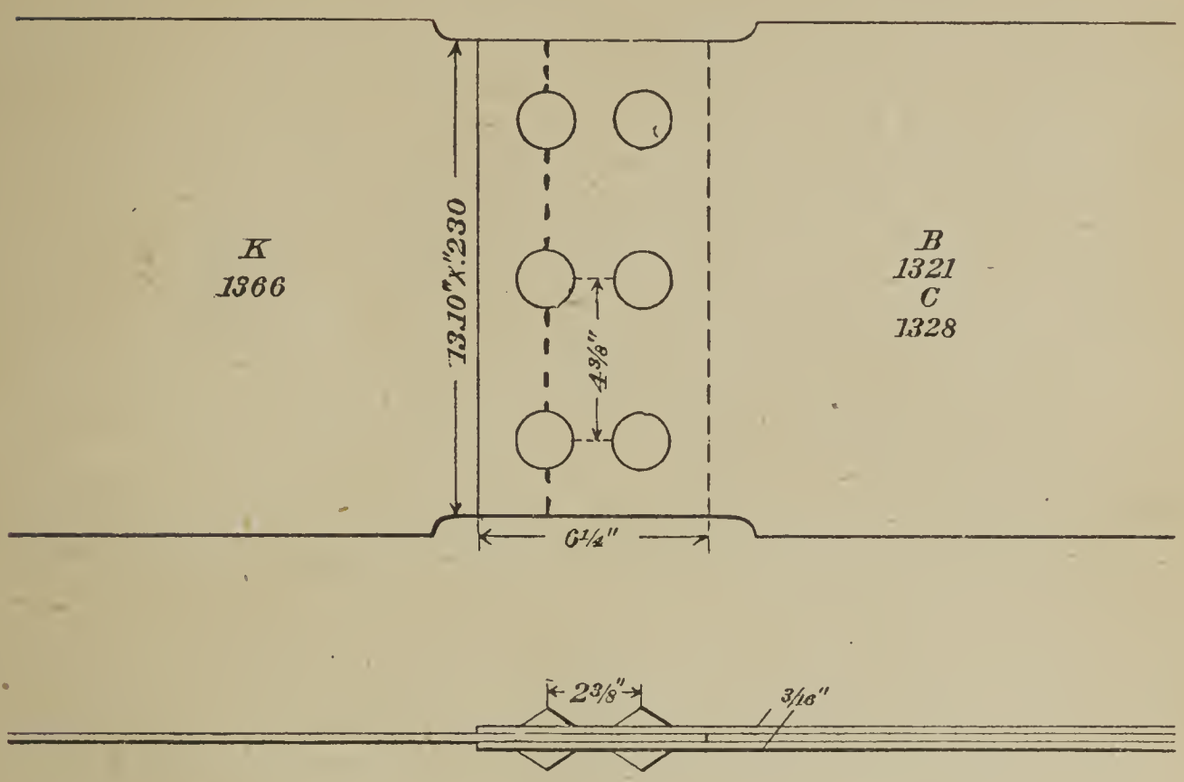
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	51,440
Tension on net section of plate	do	64,350
Compression on bearing surface of rivets	do	128,210
Shearing on rivets	do	23,470

Efficiency of joint, 83.7 per cent.

No. 4926.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $4\frac{3}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.01
Plate, net sectional area	do	2.41
Plate, bearing surface of rivets	do	1.21
Rivets, shearing area	do	7.21

Tensile strength, 167,060 pounds.

Fractured plate along first row of rivet holes. Appearance, silky lamellar.

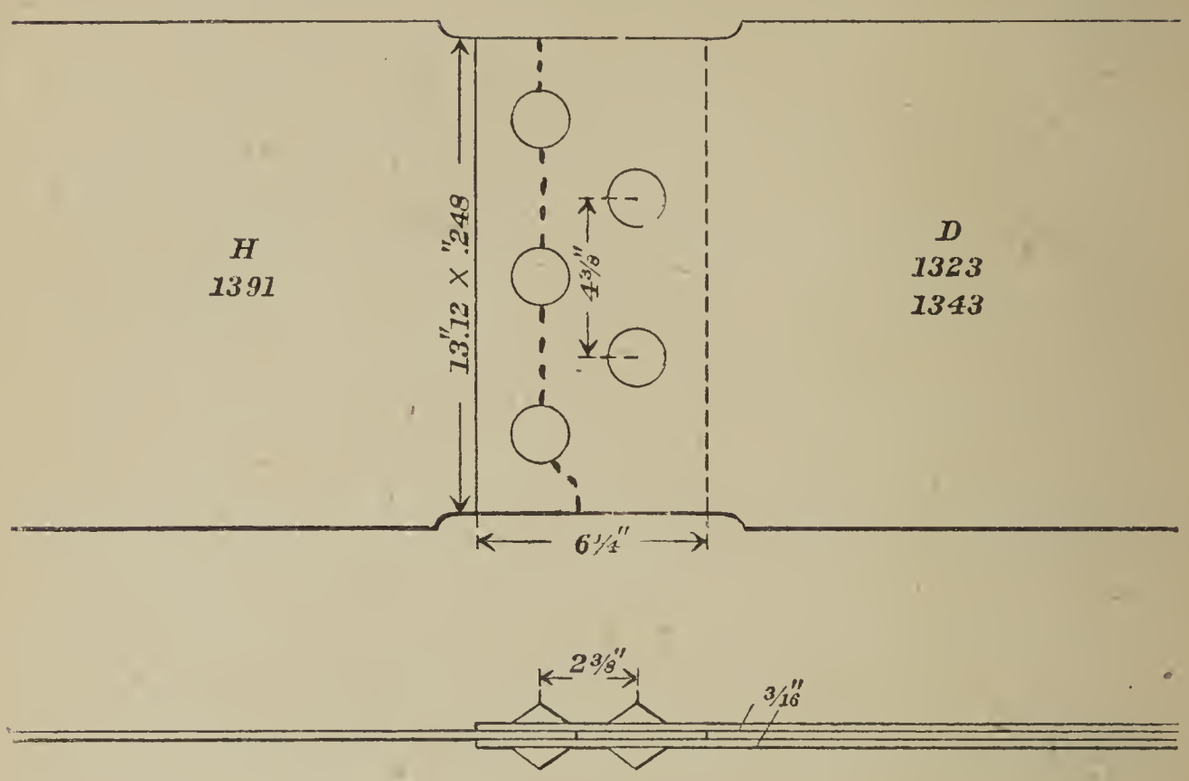
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	55,500
Tension on net section of plate	do	69,320
Compression on bearing surface of rivets	do	138,070
Shearing on rivets	do	23,170

Efficiency of joint, 95.4 per cent.

No. 4931.

($\frac{1}{4}''$ steel plate; $\frac{7}{8}''$ drilled holes; iron rivets, $4\frac{3}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	3.25
Plate, net sectional area	do	2.60
Plate, bearing surface of rivets	do	1.05
Rivets, shearing area	do	6.01

Tensile strength, 154,820 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, lamellar.

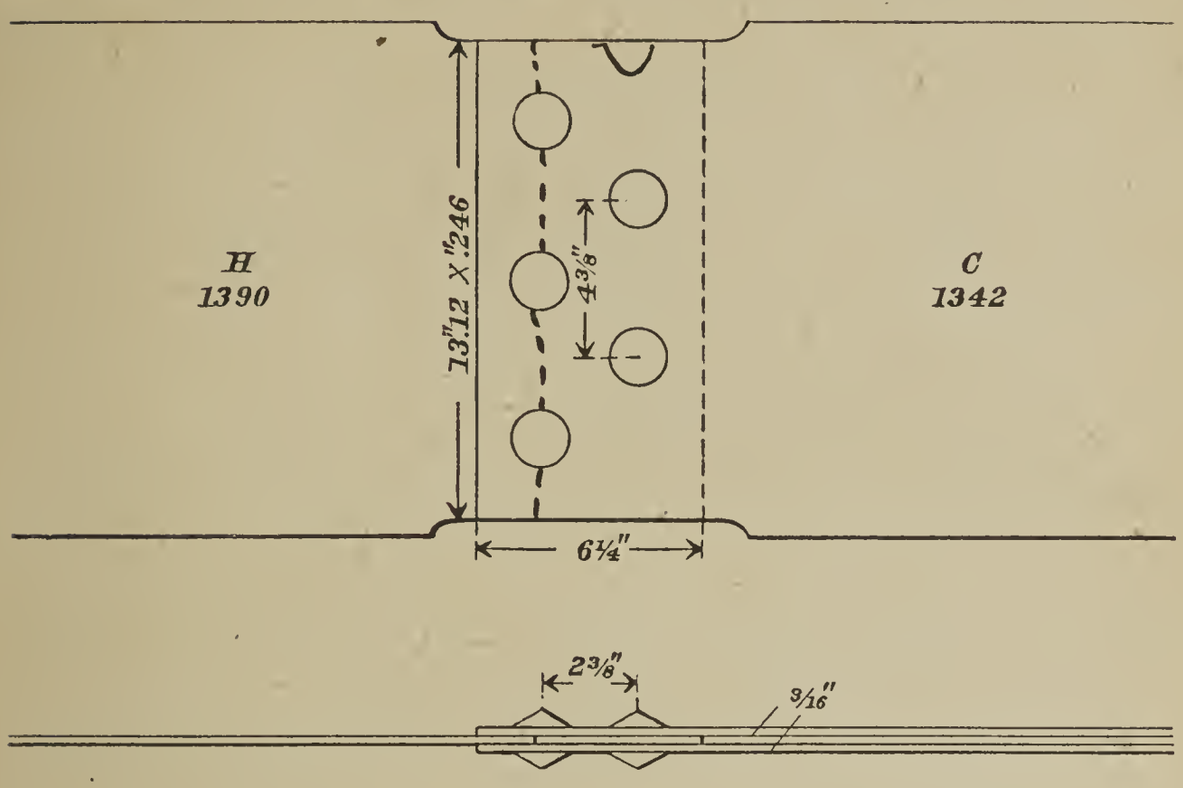
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	47,640
Tension on net section of plate	do	59,550
Compression on bearing surface of rivets	do	147,450
Shearing on rivets	do	25,760

Efficiency of joint, 80.5 per cent.

No. 4932.

($\frac{1}{4}''$ steel plate; $\frac{7}{8}''$ drilled holes; iron rivets, $4\frac{3}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	3.23
Plate, net sectional area	do	2.58
Plate, bearing surface of rivets	do	1.08
Rivets, shearing area	do	6.01

Tensile strength, 150,900 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, slightly lamellar.

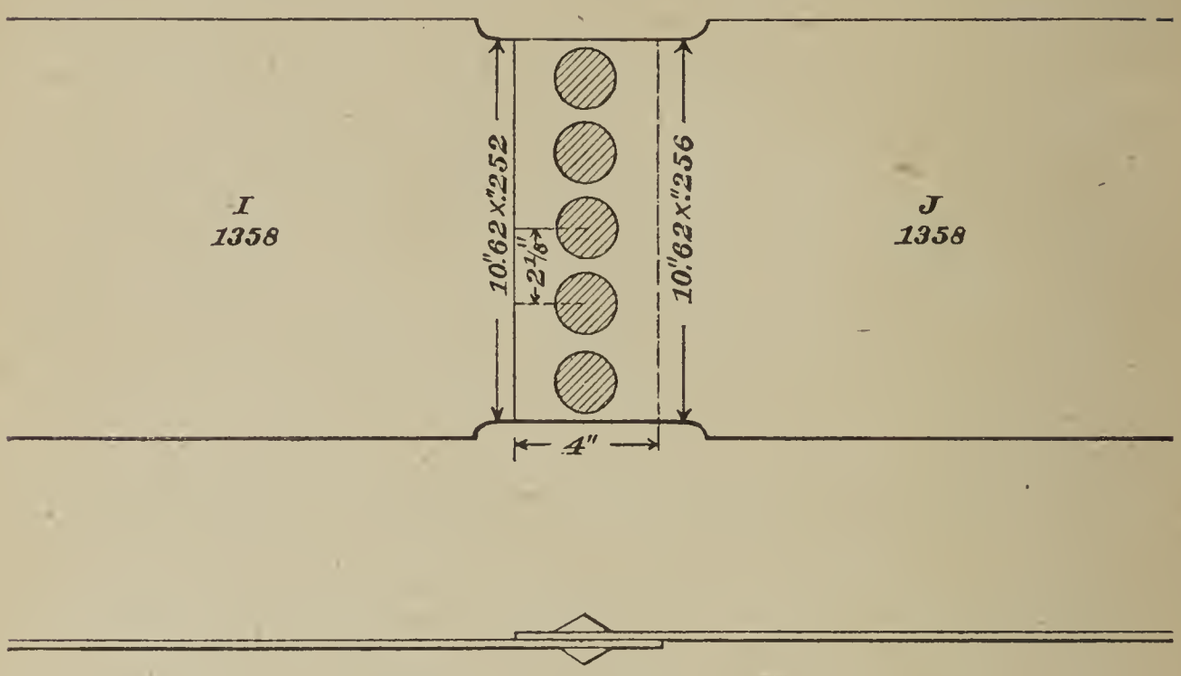
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,720
Tension on net section of plate	do	58,490
Compression on bearing surface of rivets	do	139,720
Shearing of rivets	do	25,110

Efficiency of joint, 78.9 per cent.

No. 4933.

($\frac{1}{4}''$ steel plates; $\frac{7}{8}''$ drilled holes; iron rivets, $2\frac{1}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	2.68
Plate, net sectional area	do	1.57
Plate, bearing surface of rivets	do	1.10
Rivets, shearing area	do	3.00

Tensile strength, 106,520 pounds.
Sheared the rivets.

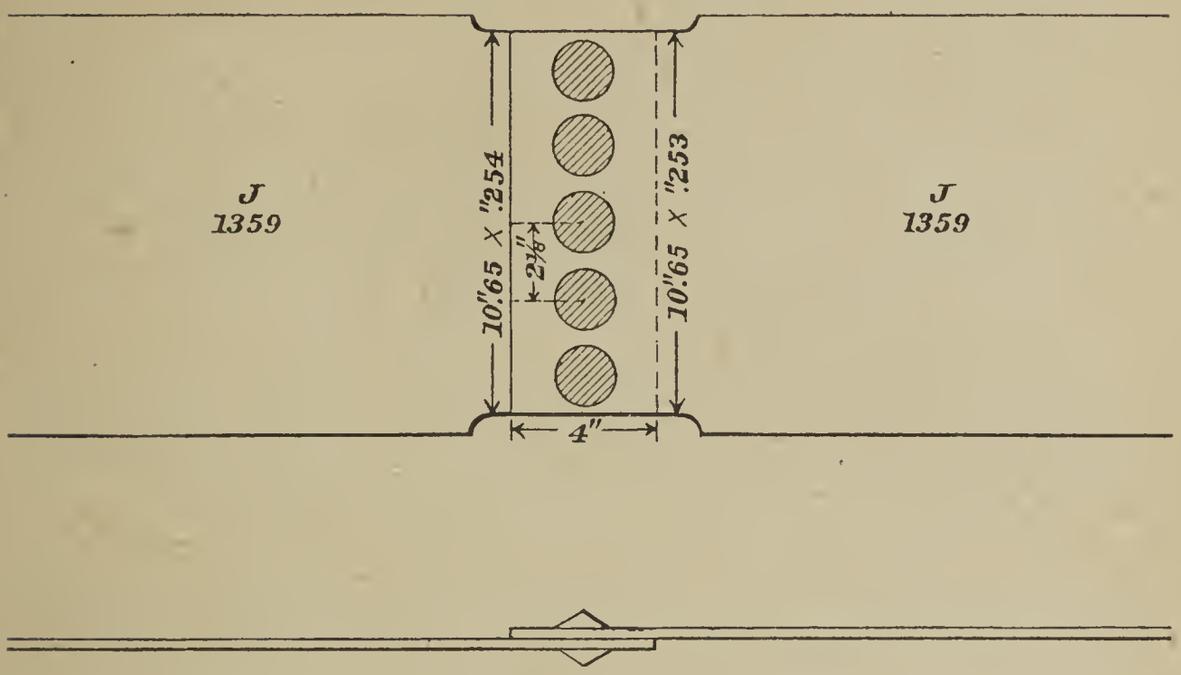
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	39,750
Tension on net section of plate	do	67,850
Compression on bearing surface of rivets	do	96,840
Shearing on rivets	do	35,510

Efficiency of joint, 65.1 per cent.

No. 4934.

($\frac{1}{4}''$ steel plates; $\frac{7}{8}''$ drilled holes; iron rivets, $2\frac{1}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	2.70
Plate, net sectional area	do	1.59
Plate, bearing surface of rivets	do	1.11
Rivets, shearing area	do	3.00

Tensile strength, 107,100 pounds.
Sheared the rivets.

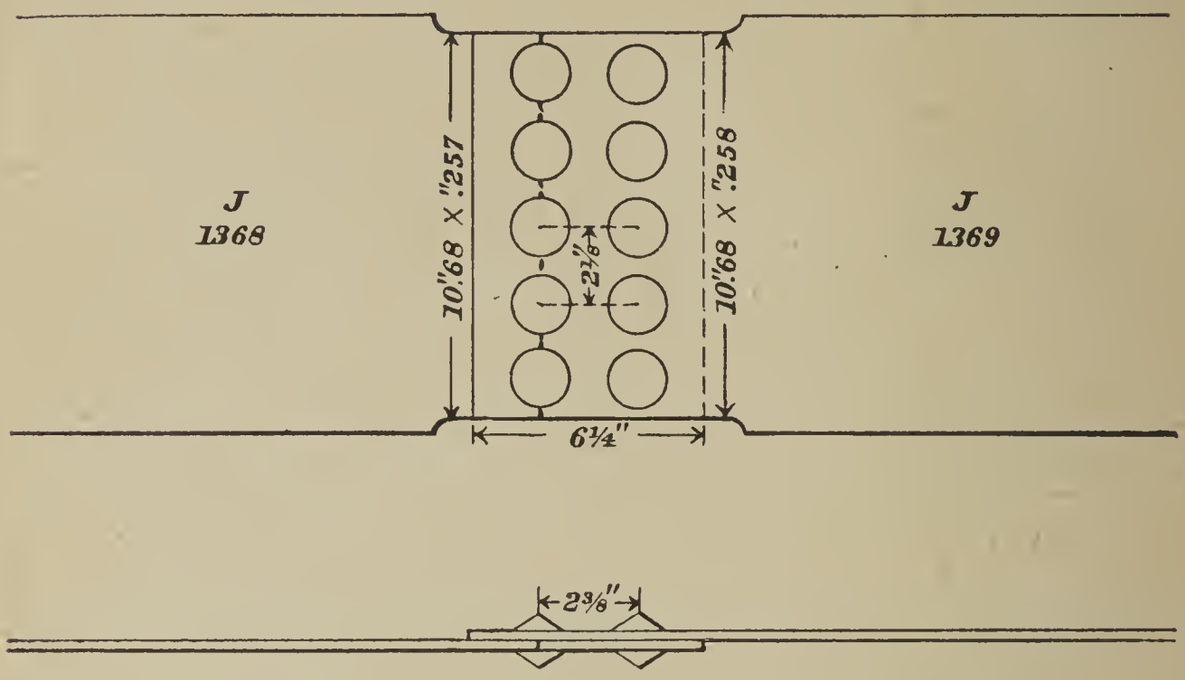
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	39,660
Tension on net section of plate	do	67,360
Compression on bearing surface of rivets	do	96,490
Shearing on rivets	do	35,700

Efficiency of joints, 65.0 per cent.

No. 4935.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	2.74
Plate, net sectional area	do	1.62
Plate, bearing surface of rivets	do	2.25
Rivets, shearing area	do	6.01

Tensile strength, 117,200 pounds.

Fractured plate J 1368 along first row of rivet holes. Appearance, silky.

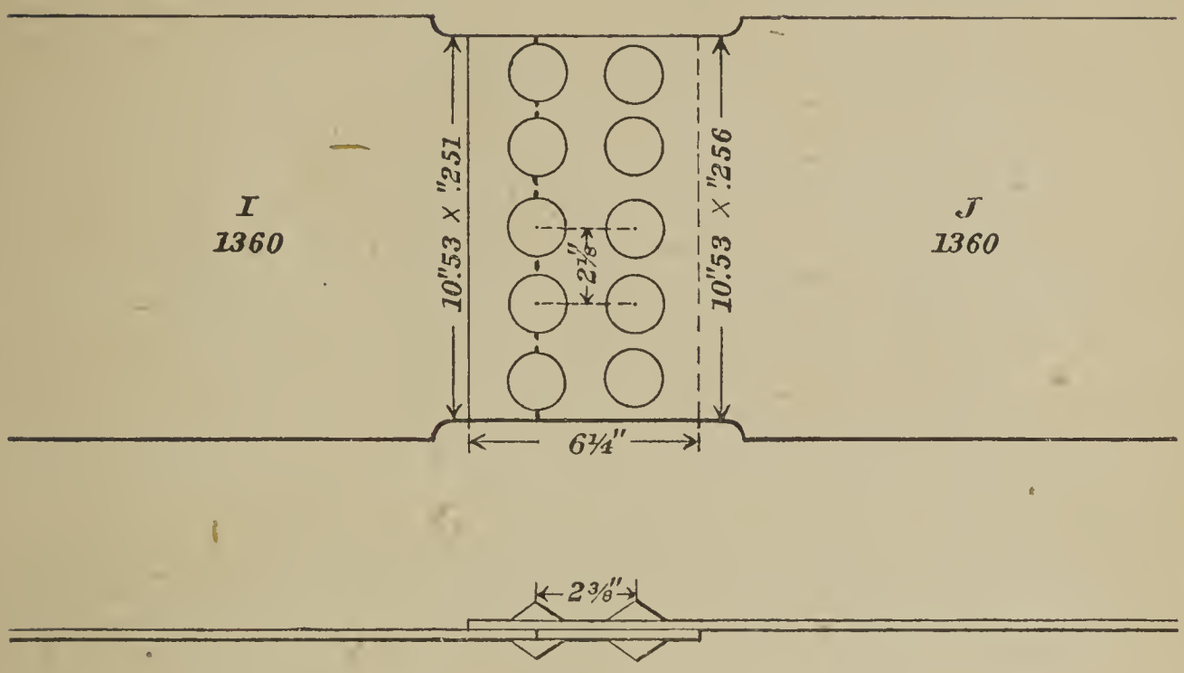
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,770
Tension on net section of plate	do	72,350
Compression on bearing surface of rivets	do	52,090
Shearing on rivets	do	19,500

Efficiency of joint, 70.1 per cent.

No. 4936.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	2.64
Plate, net sectional area	do	1.54
Plate, bearing surface of rivets	do	2.20
Rivets, shearing area	do	6.01

Tensile strength, 111,800 pounds.
Fractured plate I along first row of rivet holes. Appearance, silky.

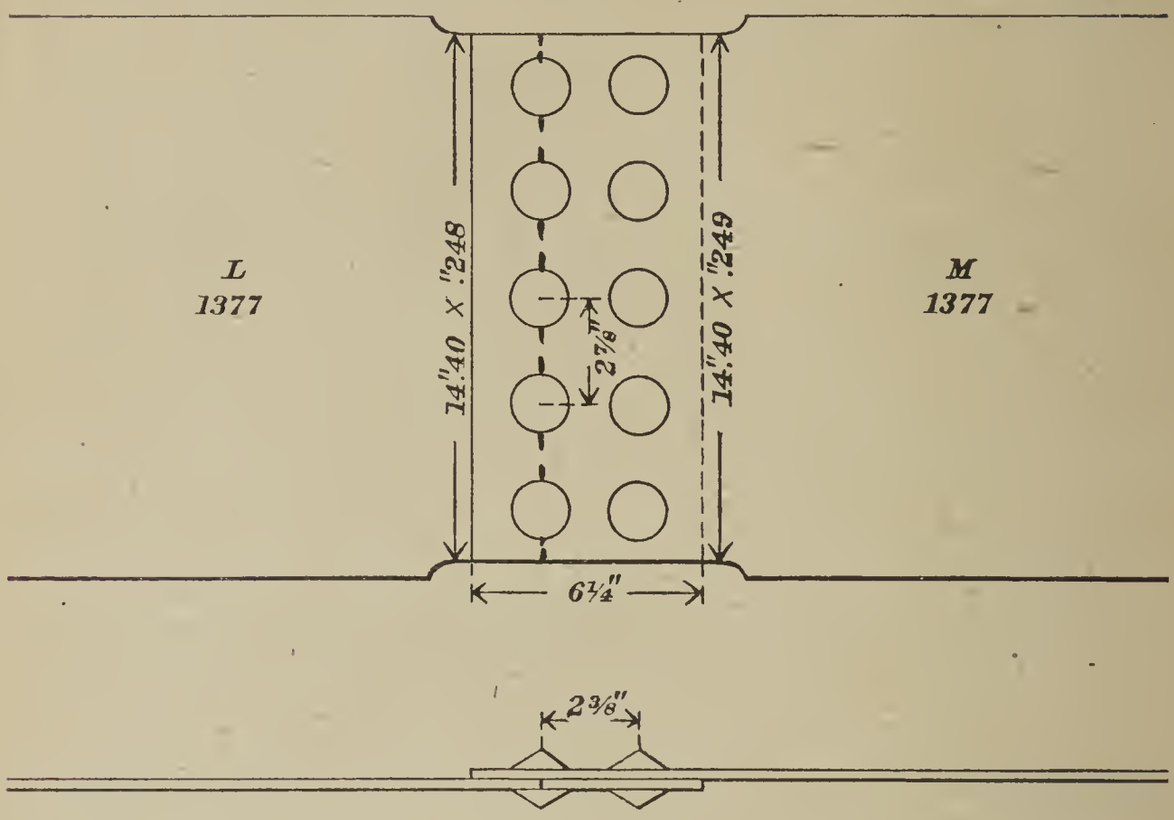
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,350
Tension on net section of plate	do	72,600
Compression on bearing surface of rivets	do	58,180
Shearing on rivets	do	18,600

Efficiency of joint, 67.9 per cent.

No. 4937.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.57
Plate, net sectional area	do	2.49
Plate, bearing surface of rivets	do	2.17
Rivets, shearing area	do	6.01

Tensile strength, 170,900 pounds.

Fractured plate L 1377 along first row of rivet holes. Appearance, silky, slightly lamellar.

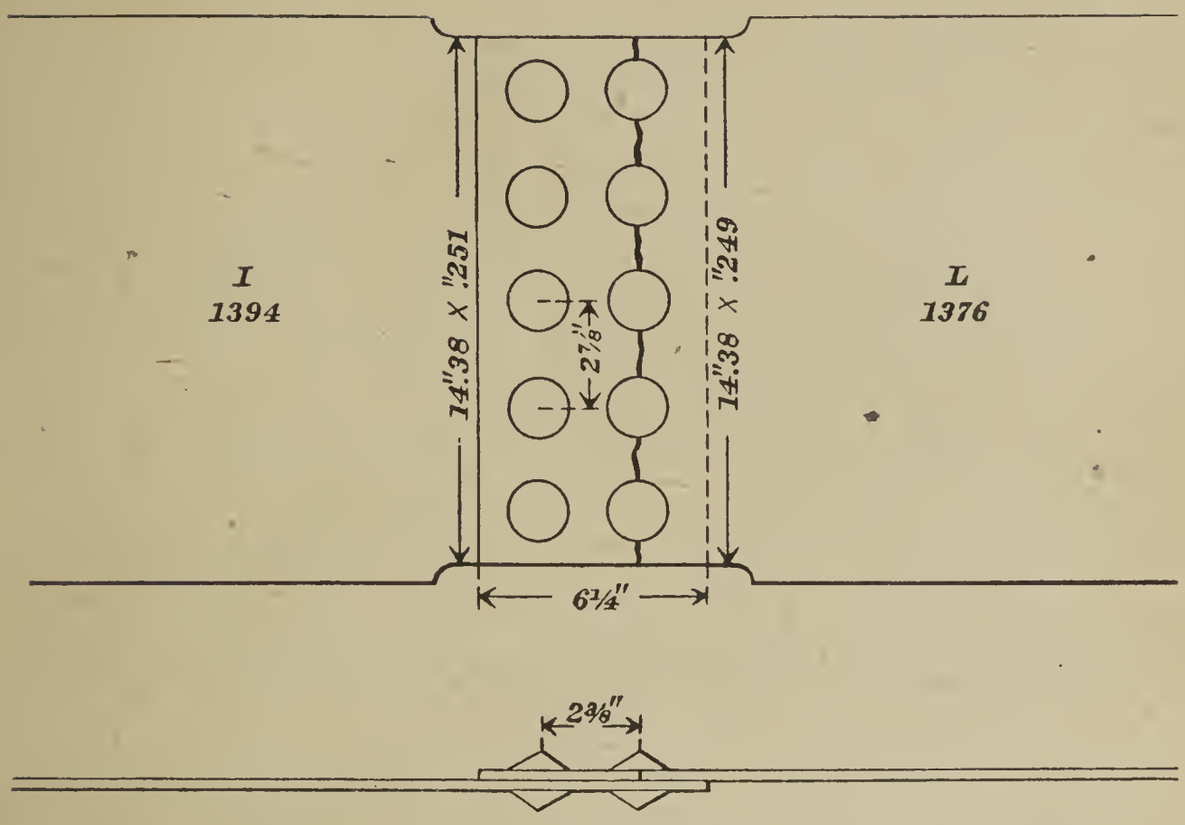
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	47,870
Tension on net section of plate	do	68,630
Compression on bearing surface of rivets	do	78,760
Shearing on rivets	do	28,440

Efficiency of joint, 77.9 per cent.

No. 4938.

($\frac{1}{4}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.58
Plate, net sectional area	do	2.49
Plate, bearing surface of rivets	do	2.18
Rivets, shearing area	do	6.01

Tensile strength, 173,750 pounds.

Fractured plate L 1376 along first row of rivet holes. Appearance, silky.

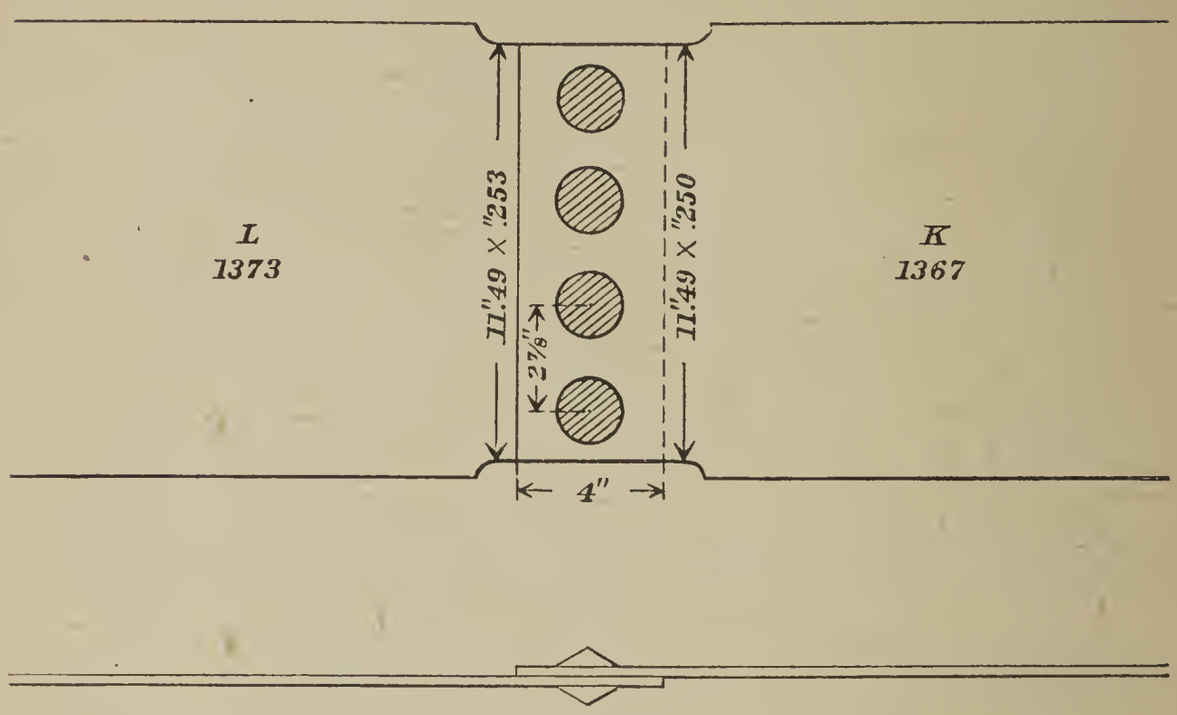
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	48,530
Tension on net section of plate	do	69,780
Compression on bearing surface of rivets	do	79,700
Shearing on rivets	do	28,910

Efficiency of joint, 78.9 per cent.

No. 4939.

($\frac{1}{4}$″ steel plate; 1″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches..	2.87
Plate, net sectional area	do....	1.87
Plate, bearing surface of rivets	do....	1.00
Rivets, shearing area	do....	3.14

Tensile strength, 116,400 pounds.
Sheared the rivets.

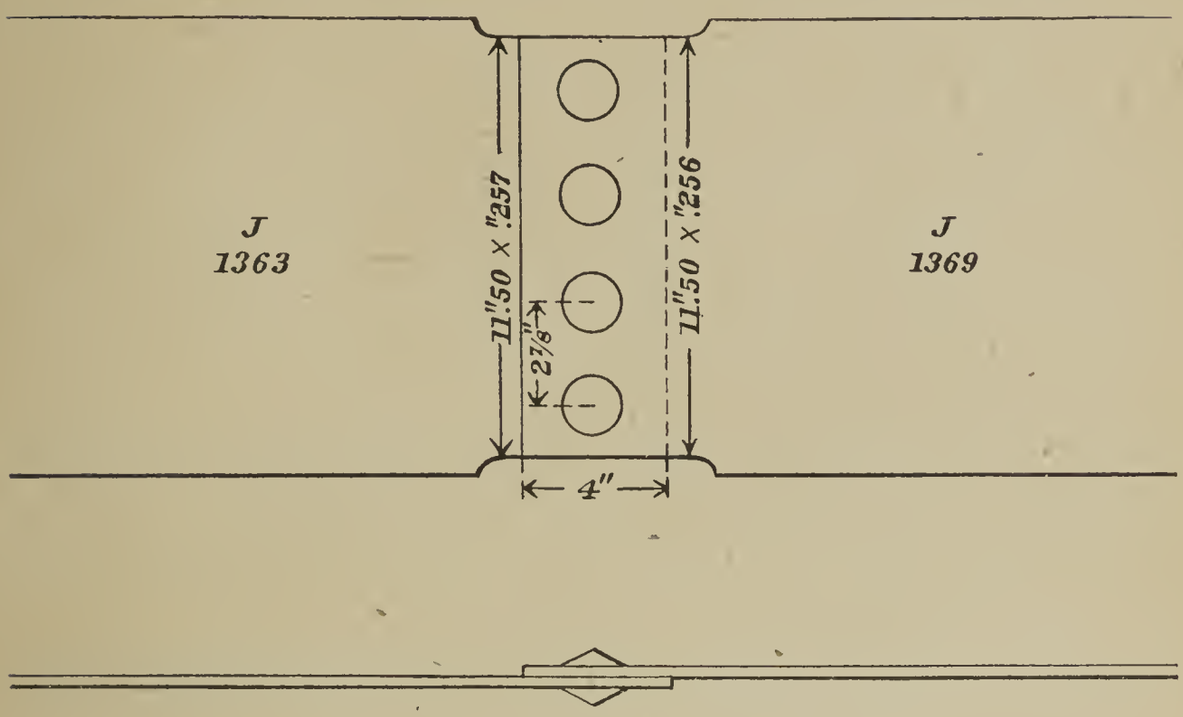
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	40,560
Tension on net section of plate	do....	62,250
Compression on bearing surface of rivets	do....	116,400
Shearing on rivets	do....	37,070

Average elongation of rivet holes, ″.16 each.
Efficiency of joint, 69.7 per cent.

No. 4940.

($\frac{1}{4}$″ steel plate; 1″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	2.94
Plate, net sectional area	do	1.92
Plate, bearing surface of rivets	do	1.02
Rivets, shearing area	do	3.14

Tensile strength, 108,800 pounds.

Pulled off rivet heads. Plate not fractured. Average elongation of rivet holes, ″.15 each.

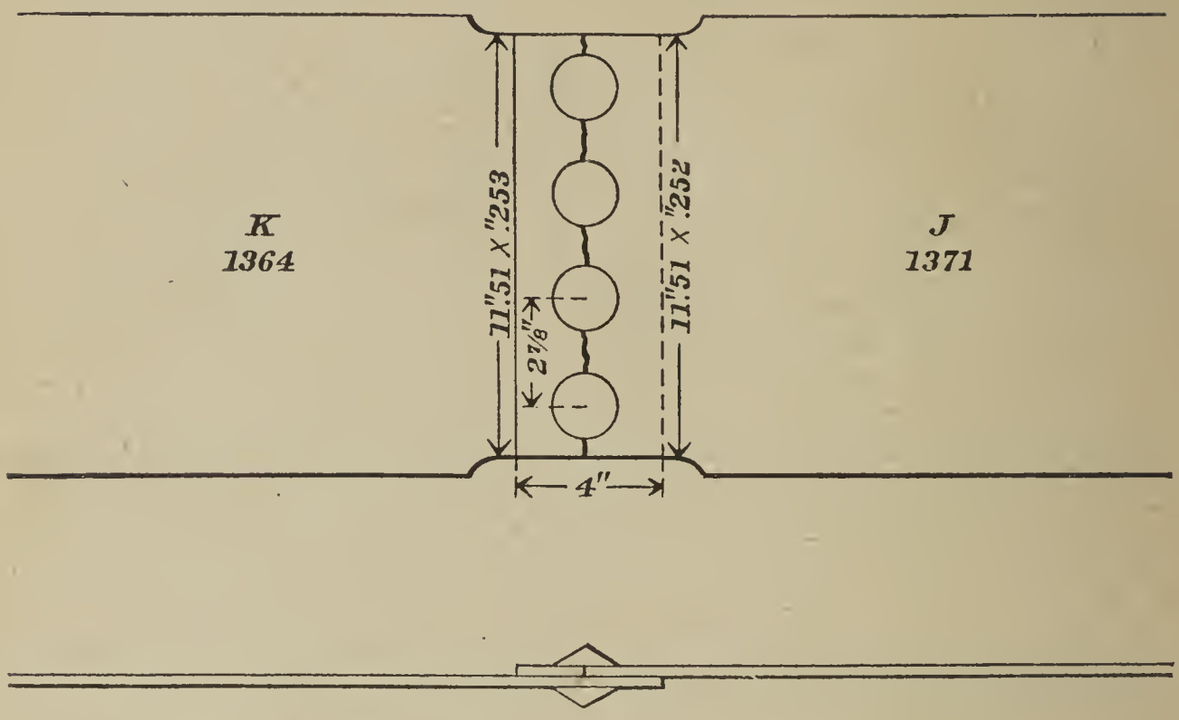
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	37,010
Tension on net section of plate	do	56,670
Compression on bearing surface of rivets	do	106,670
Shearing on rivets	do	34,650

Efficiency of joint, 60.6 per cent.

No. 4941.

($\frac{1}{4}$″ steel plate; $1\frac{1}{8}$″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	2.90
Plate, net sectional area	do	1.77
Plate, bearing surface of rivets	do	1.13
Rivets, shearing area	do	3.98

Tensile strength, 125,500 pounds.
Fractured Plate J along line of rivet holes. Appearance, silky.

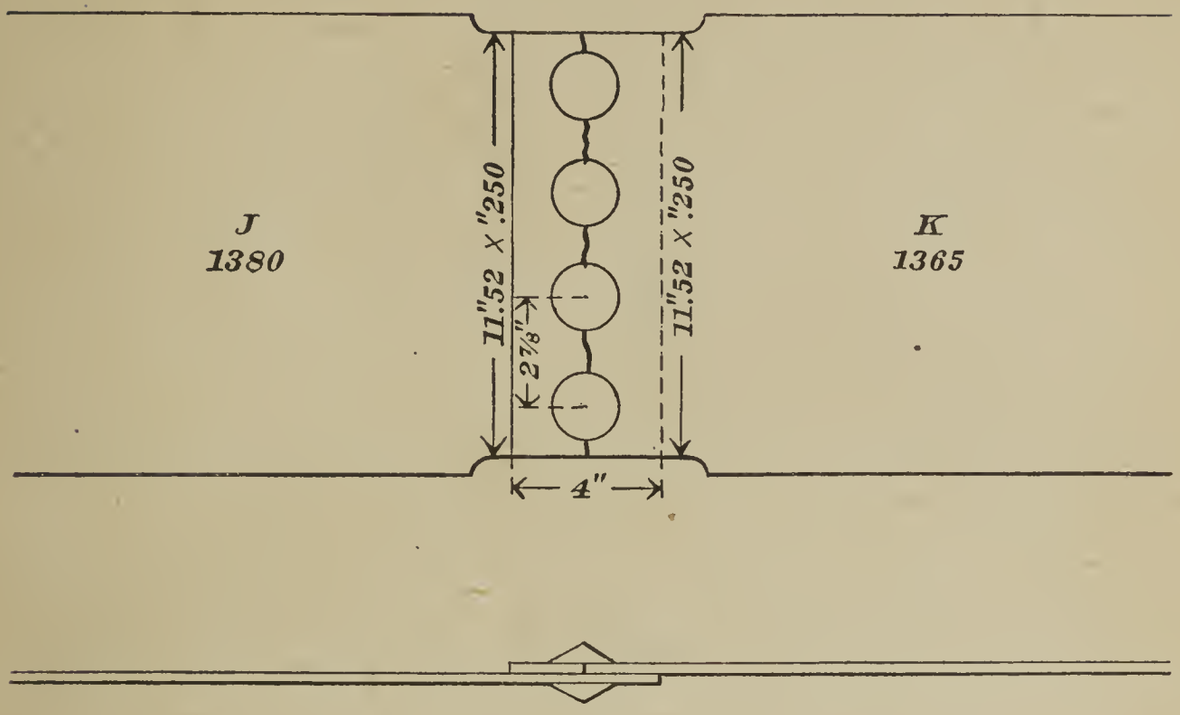
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	43,280
Tension on net section of plate	do	70,900
Compression on bearing surface of rivets	do	111,060
Shearing on rivets	do	31,530

Efficiency of joint, 70.9 per cent.

No. 4942.

($\frac{1}{4}$″ steel plate; $1\frac{1}{8}$″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	2.88
Plate, net sectional area	do	1.75
Plate, bearing surface of rivets	do	1.13
Rivets, shearing area	do	3.98

Tensile strength, 123,180 pounds.

Fractured Plate K along line of rivet holes. Appearance, silky, lamellar.

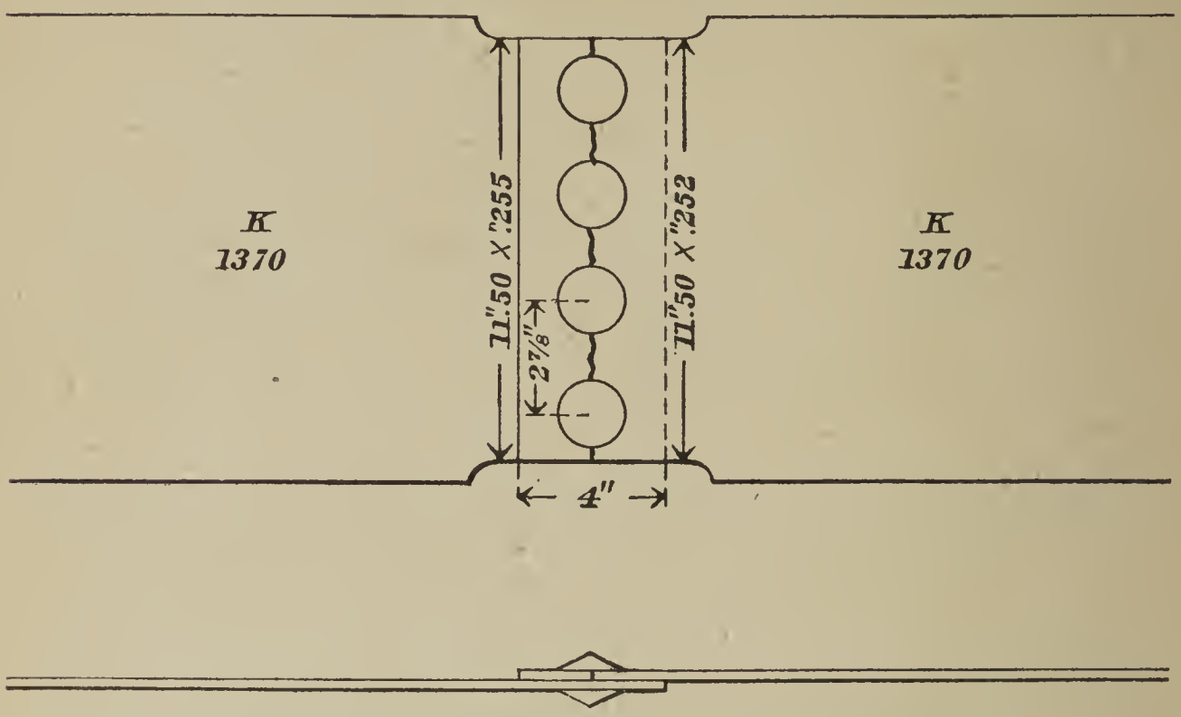
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,770
Tension on net section of plate	do	73,880
Compression on bearing surface of rivets	do	119,010
Shearing on rivets	do	30,950

Efficiency of joint, 73.5 per cent.

No. 4943.

($\frac{1}{4}$″ steel plate; $1\frac{1}{4}$″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	2.90
Plate, net sectional area	do	1.64
Plate, bearing surface of rivets	do	1.26
Rivets, shearing area	do	4.91

Tensile strength, 119,270 pounds.

Fractured plate along line of rivet holes. Appearance, silky, lamellar.

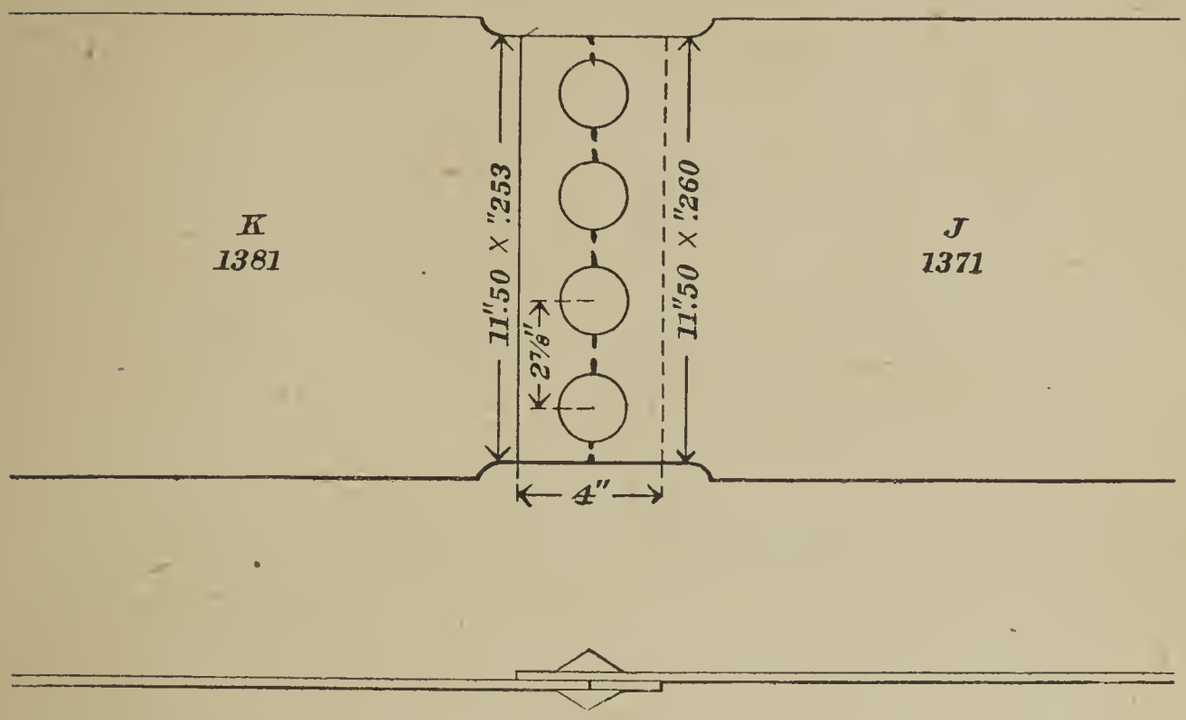
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	41,130
Tension on net section of plate	do	72,730
Compression on bearing surface of rivets	do	94,660
Shearing on rivets	do	24,290

Efficiency of joint, 70.7 per cent.

No. 4944.

($\frac{1}{4}''$ steel plate; $1\frac{1}{4}$ drilled holes; iron rivets, $2\frac{7}{8}''$ pitch.)



Area.

Plate, gross sectional area	square inches	2.91
Plate, net sectional area	do	1.64
Plate, bearing surface of rivets	do	1.27
Rivets, shearing area	do	4.91

Tensile strength, 116,980 pounds.

Fractured plate K along line of rivet holes. Appearance silky, slightly lamellar.

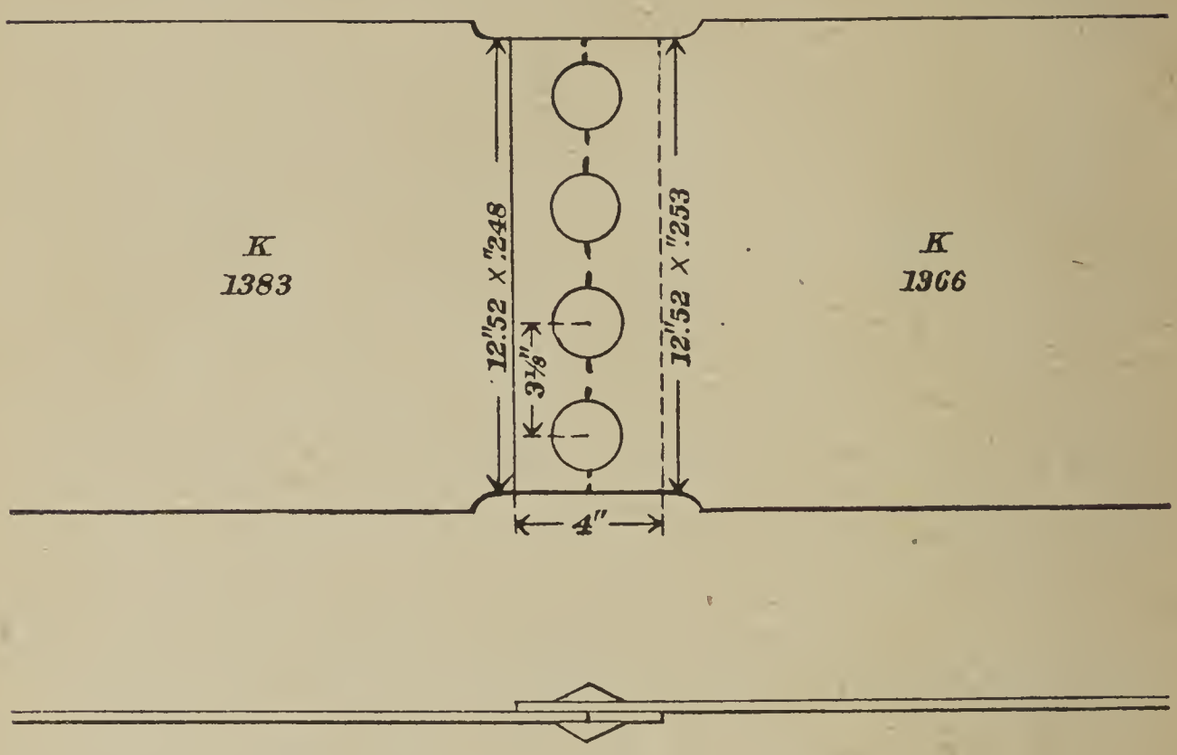
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	40,200
Tension on net section of plate	do	71,330
Compression on bearing surface of rivets	do	92,110
Shearing on rivets	do	23,820

Efficiency of joint, 69.1 per cent.

No. 4945.

($\frac{1}{4}''$ steel plate; $1\frac{1}{4}''$ drilled holes; iron rivets, $3\frac{1}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	3.10
Plate, net sectional area	do	1.86
Plate, bearing surface of rivets	do	1.24
Rivets, shearing area	do	4.91

Tensile strength, 124,100 pounds.

Fractured plate K 1383 along line of rivet holes. Appearance, silky.

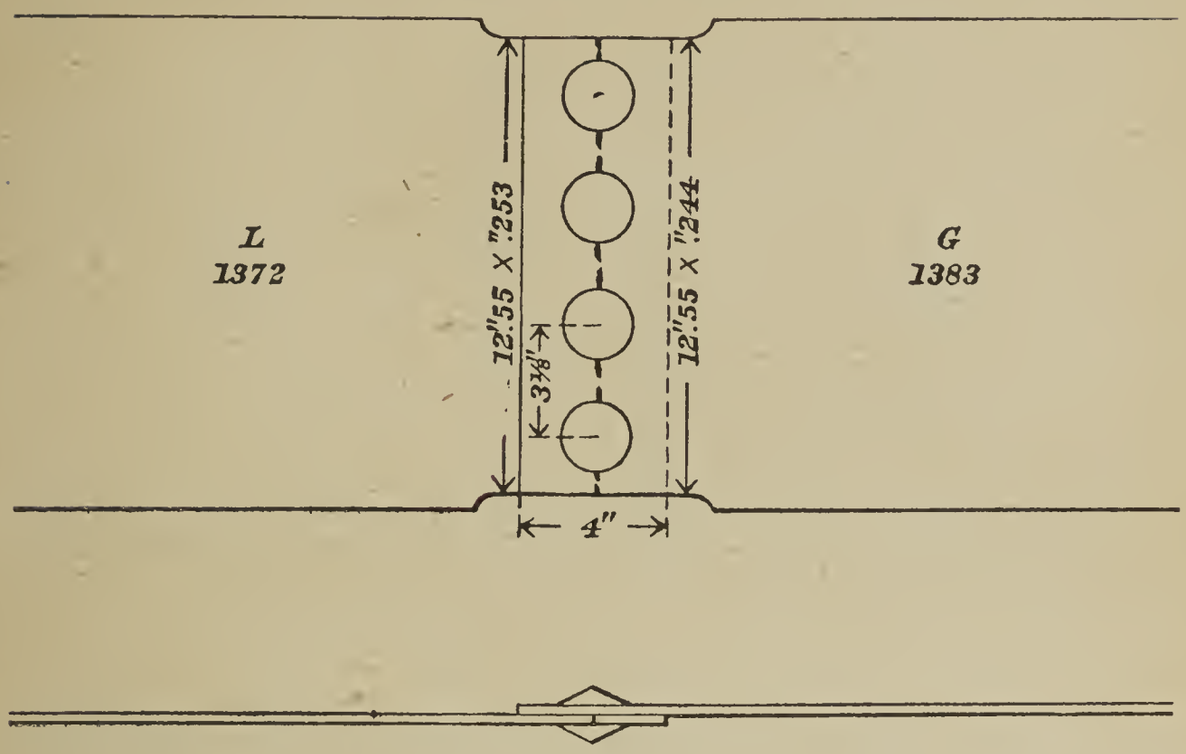
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	40,030
Tension on net section of plate	do	66,720
Compression on bearing surface of rivets	do	100,080
Shearing on rivets	do	25,270

Efficiency of joint, 69.1 per cent.

No. 4946.

($\frac{1}{4}''$ steel plate; $1\frac{1}{4}''$ drilled holes; iron rivets, $3\frac{1}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	3.17
Plate, net sectional area	do	1.91
Plate, bearing surface of rivets	do	1.26
Rivets, shearing area	do	4.91

Tensile strength, 132,400 pounds.

Fractured plate L along line of rivet holes. Appearance, silky.

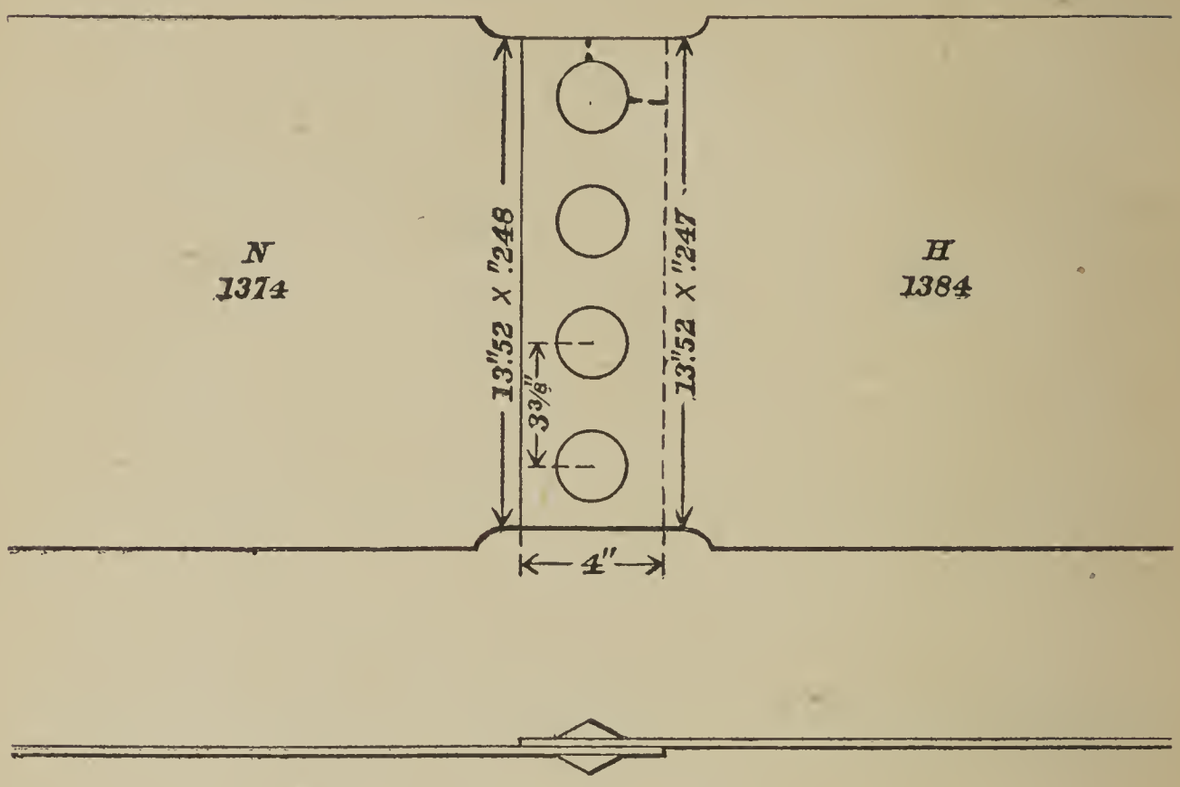
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	41,770
Tension on net section of plate	do	69,320
Compression on bearing surface of rivets	do	105,080
Shearing on rivets	do	26,970

Efficiency of joint, 68.0 per cent.

No. 4947.

($\frac{1}{4}''$ steel plate; $1\frac{1}{4}''$ drilled holes; iron rivets, $3\frac{3}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	3.34
Plate, net sectional area	do	2.10
Plate, bearing surface of rivets	do	1.24
Rivets, shearing area	do	4.91

Tensile strength, 141,080 pounds.
Pulled heads off three rivets, and tore out plate at one.

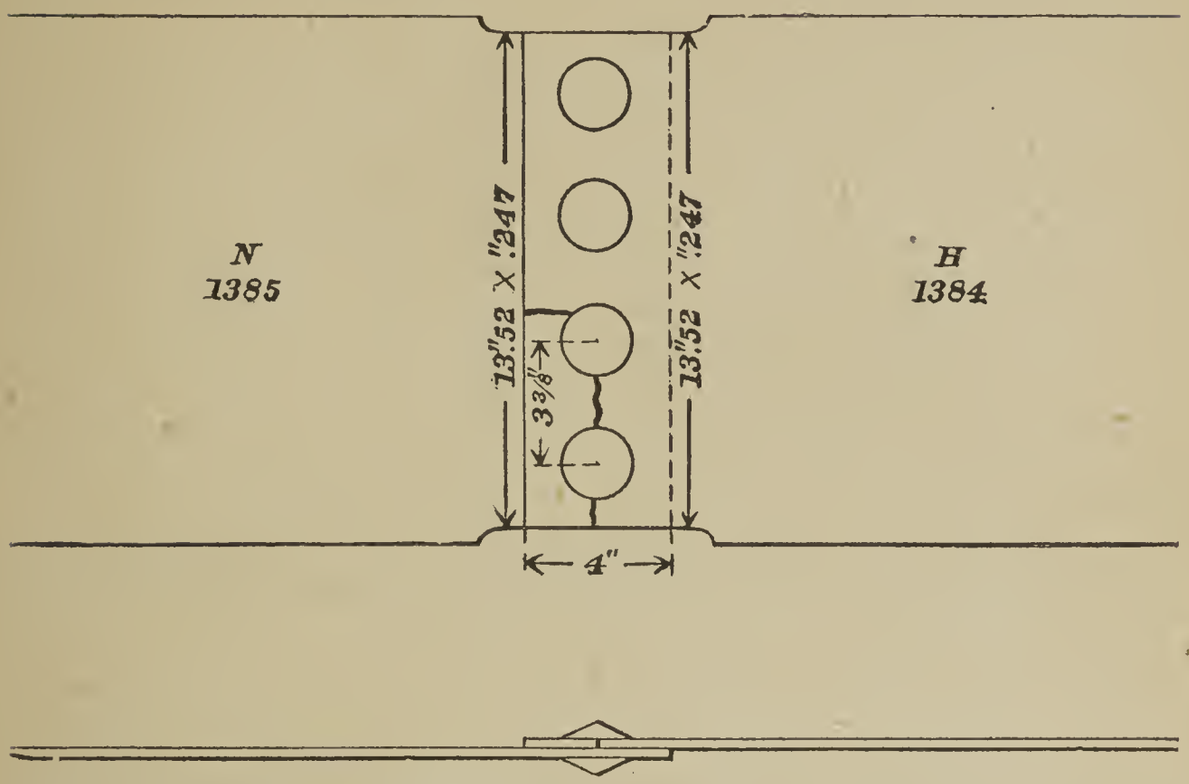
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,240
Tension on net section of plate	do	67,180
Compression on bearing surface of rivets	do	112,970
Shearing on rivets	do	28,730

Efficiency of joint, 75.7 per cent.

No. 4948.

($\frac{1}{4}$″ steel plate; $1\frac{1}{4}$″ drilled holes; iron rivets, $3\frac{3}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.34
Plate, net sectional area	do	2.10
Plate, bearing surface of rivets	do	1.24
Rivets, shearing area	do	4.91

Tensile strength, 142,300 pounds.

Fractured across two sections between rivet holes, and tore off heads of two rivets.

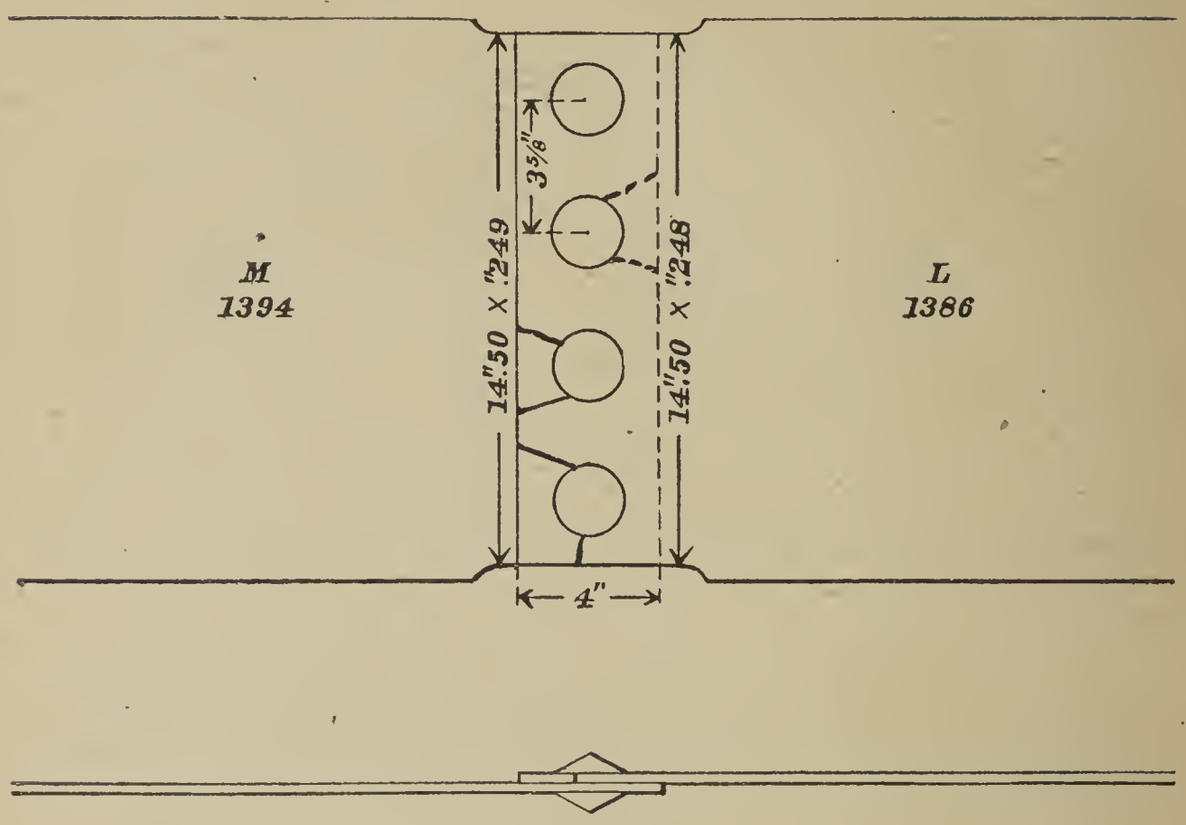
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,600
Tension on net section of plate	do	67,760
Compression on bearing surface of rivets	do	114,760
Shearing on rivets	do	28,980

Efficiency of joint, 71.9 per cent.

No. 4949.

($\frac{1}{4}$″ steel plate; $1\frac{1}{4}$″ drilled holes; iron rivets, $3\frac{5}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.60
Plate, net sectional area	do	2.36
Plate, bearing surface of rivets	do	1.24
Rivets, shearing area	do	4.91

Tensile strength, 149,020 pounds.
Tore out plate in front of holes and pulled off rivet heads.

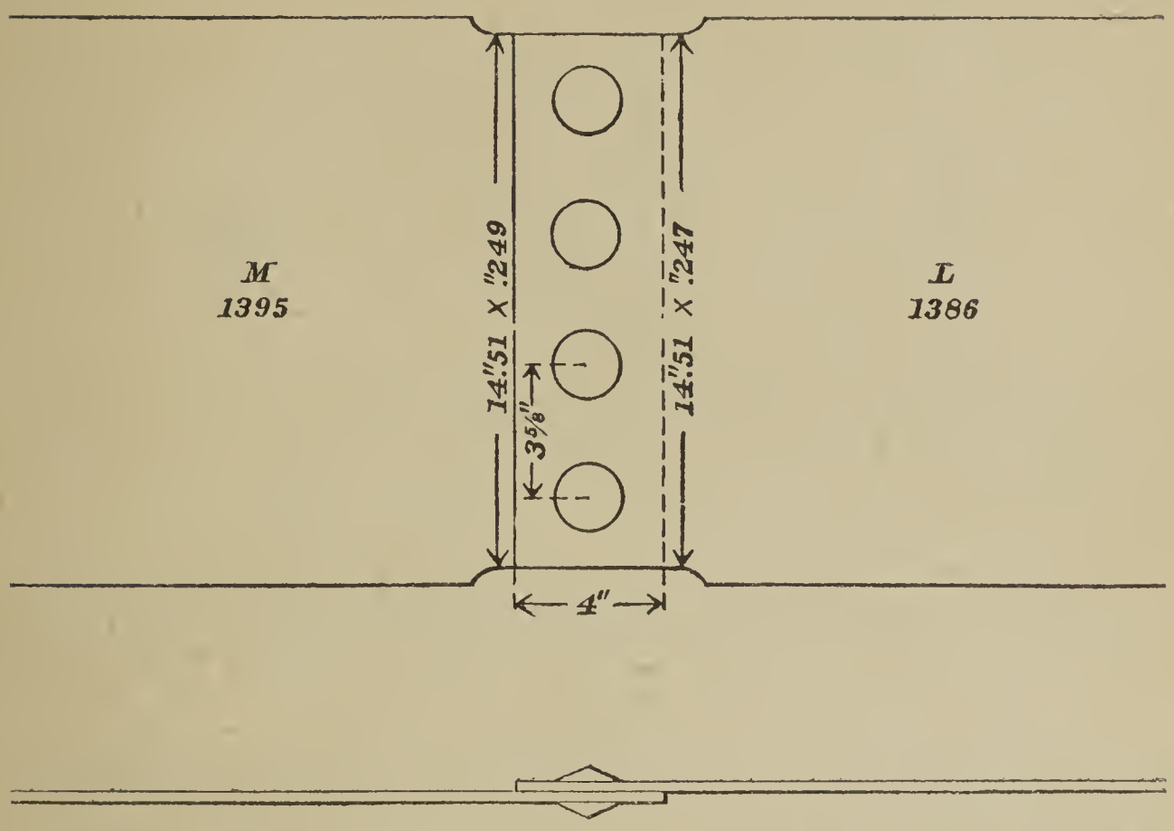
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	41,390
Tension on net section of plate	do	63,140
Compression on bearing surface of rivets	do	120,180
Shearing on rivets	do	30,350

Efficiency of joint, 67.3 per cent.

No. 4950.

($\frac{1}{4}''$ steel plate; $1\frac{1}{4}''$ drilled holes; iron rivets, $3\frac{5}{8}''$ pitch.)



Areas.

Plate, gross sectional area	square inches	3.58
Plate, net sectional area	do	2.35
Plate, bearing surface of rivets	do	1.23
Rivets, shearing area	do	4.91

Tensile strength, 150,900 pounds.

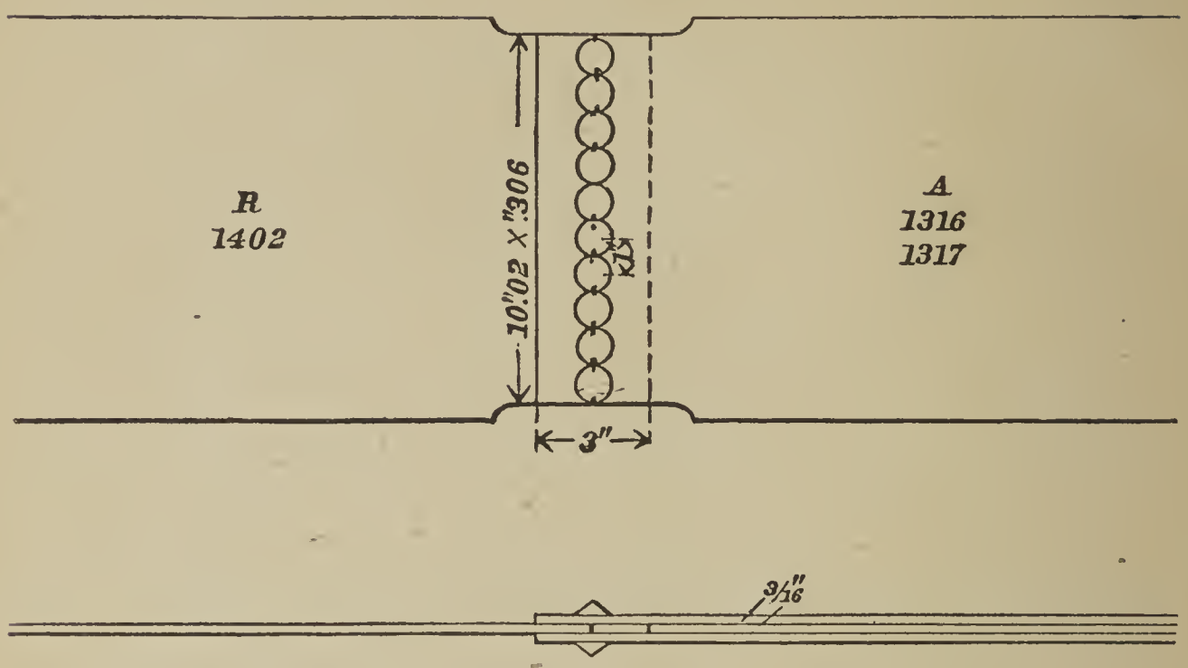
Pulled off rivet heads. Plates not fractured. Maximum elongation of rivet holes ".46.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,150
Tension on net section of plate	do	64,210
Compression on bearing surface of rivets	do	122,680
Shearing on rivets	do	30,730

No. 5125.

($\frac{5}{16}$″ steel plate; $\frac{1}{2}$″ drilled holes; iron rivets, 1″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.07
Plate, net sectional area	do	1.54
Plate, bearing surface of rivets	do	1.53
Rivets, shearing area	do	3.92

Tensile strength, 110,300 pounds.
Fractured plate along line of rivet holes. Appearance, silky.

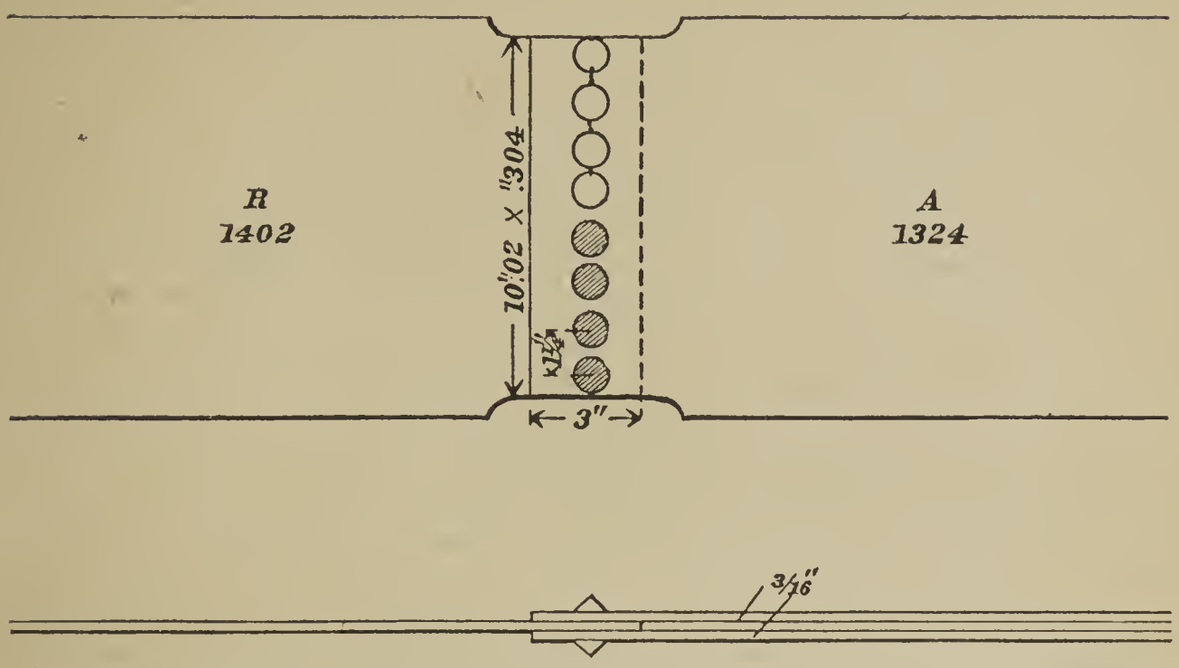
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	35,930
Tension on net section of plate	do	71,620
Compression on bearing surface of rivets	do	72,090
Shearing on rivets	do	28,140

Efficiency of joint, 58.8 per cent.

No. 5126.

($\frac{5}{16}$″ steel plate; $\frac{1}{2}$″ drilled holes; iron rivets, $1\frac{1}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.05
Plate, net sectional area	do	1.83
Plate, bearing surface of rivets	do	1.22
Rivets, shearing area	do	3.14

Tensile strength, 125,900 pounds.

Sheared four rivets and fractured plate across four sections. Appearance, silky.

Elongation of rivet holes in which rivets sheared, ".20, ".10, ".10, ".10.

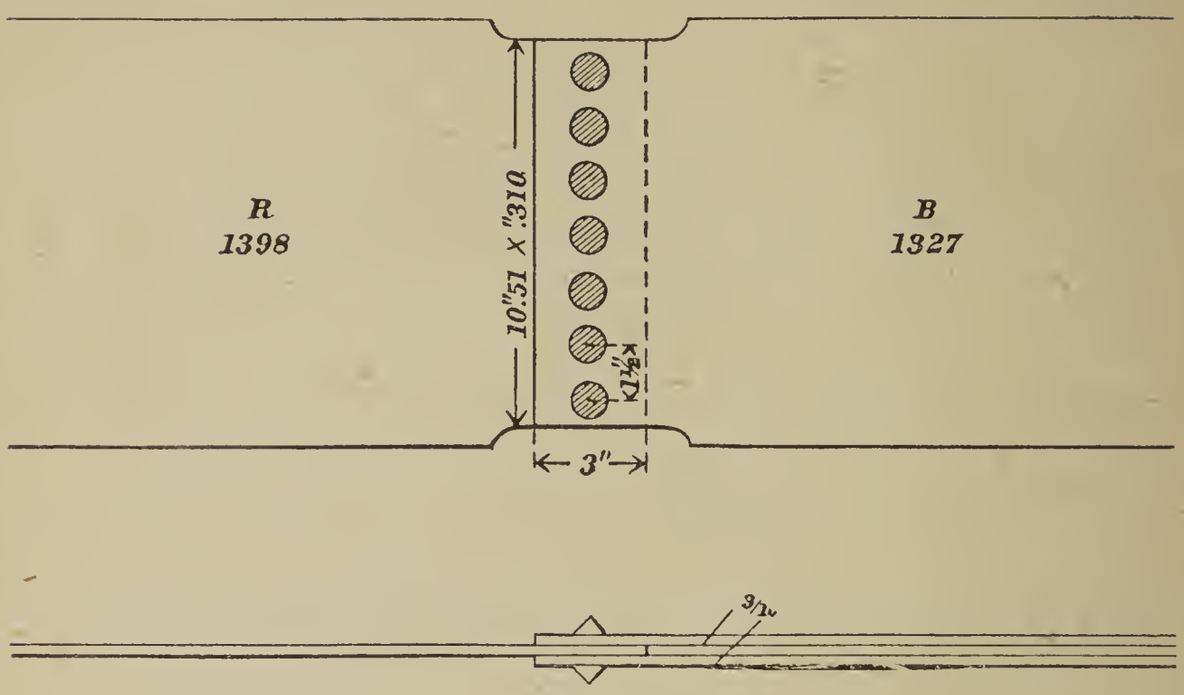
Maximum stress on joint

Tension on gross section of plate	pounds per square inch	41.280
Tension on net section of plate	do	68,800
Compression on bearing surface of rivets	do	103,200
Shearing on rivets	do	40,100

Efficiency of joint, 67.5 per cent.

No. 5127.

($\frac{5}{16}$″ steel plate; $\frac{1}{2}$″ drilled holes; iron rivets, $1\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.26
Plate, net sectional area	do	2.17
Plate, bearing surface of rivets	do	1.09
Rivets, shearing area	do	2.74

Tensile strength, 127,940 pounds.
Sheared the rivets.
Average elongation of rivet holes, ″.10.

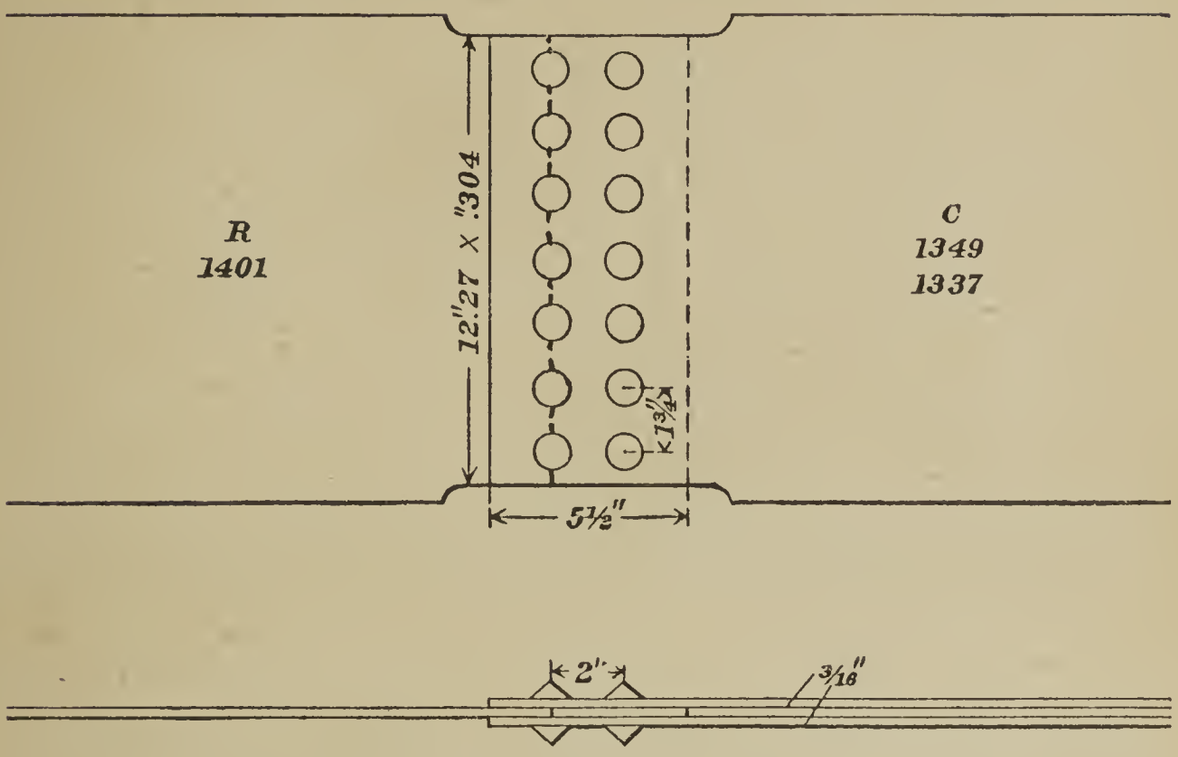
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	39,250
Tension on net section of plate	do	58,960
Compression on bearing surface of rivets	do	117,380
Shearing on rivets	do	46,690

Efficiency of joint, 64.2 per cent.

No. 5128.

($\frac{5}{16}$″ steel plate; $\frac{1}{2}$″ drilled holes; iron rivets, $1\frac{3}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.73
Plate, net sectional area	do	2.66
Plate, bearing surface of rivets	do	2.13
Rivets, shearing area	do	5.49

Tensile strength, 177,300 pounds.
Fractured plate along first row of rivet holes. Appearance, silky.

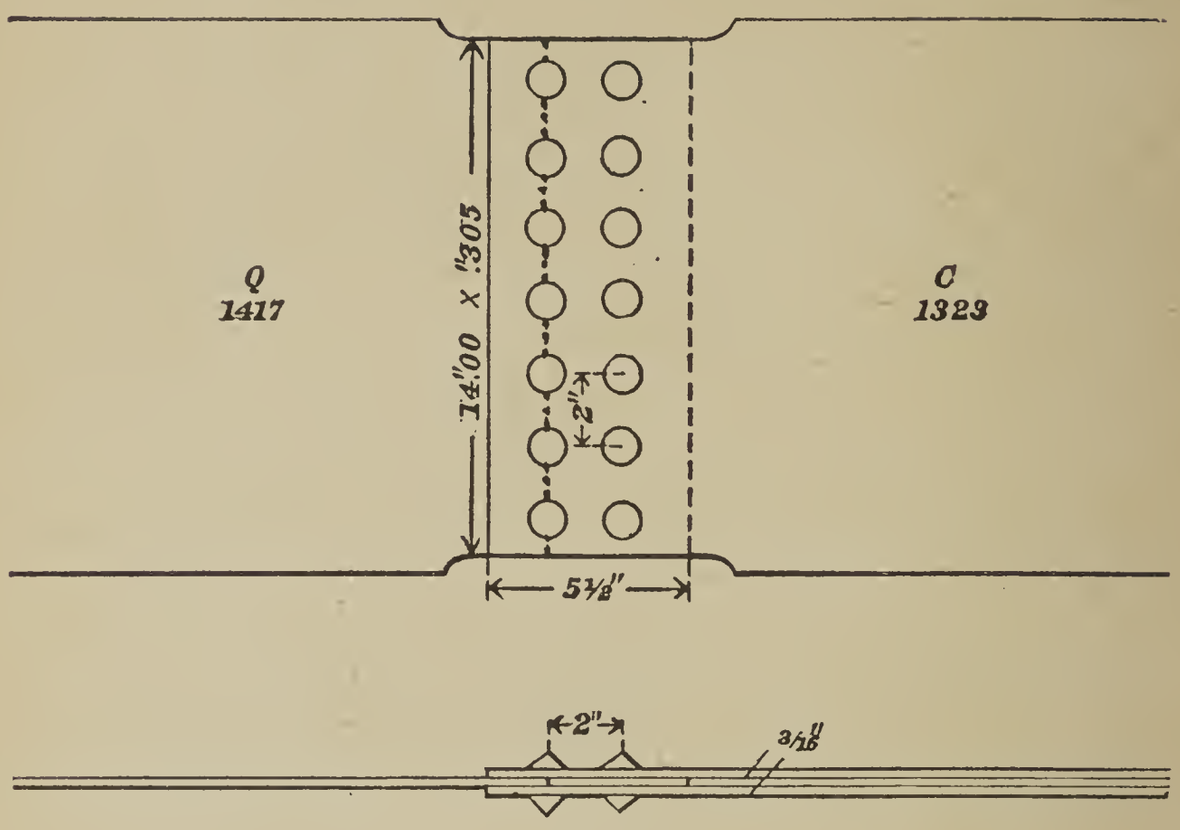
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,690
Tension on net section of plate	do	66,650
Compression on bearing surface of rivets	do	83,240
Shearing on rivets	do	32,300

Efficiency of joint, 76.4 per cent.

No. 5129.

($\frac{5}{16}$″ steel plate; $\frac{1}{2}$″ drilled holes; iron rivets, 2″ pitch.)



Areas.

Plate, gross sectional area	square inches	..	4.27
Plate, net sectional area	do	....	3.20
Plate, bearing surface of rivets	do	....	2.14
Rivets, shearing area	do	....	5.49

Tensile strength, 209,390 pounds.
Fractured plate along first row of rivet holes. Appearance, silky.

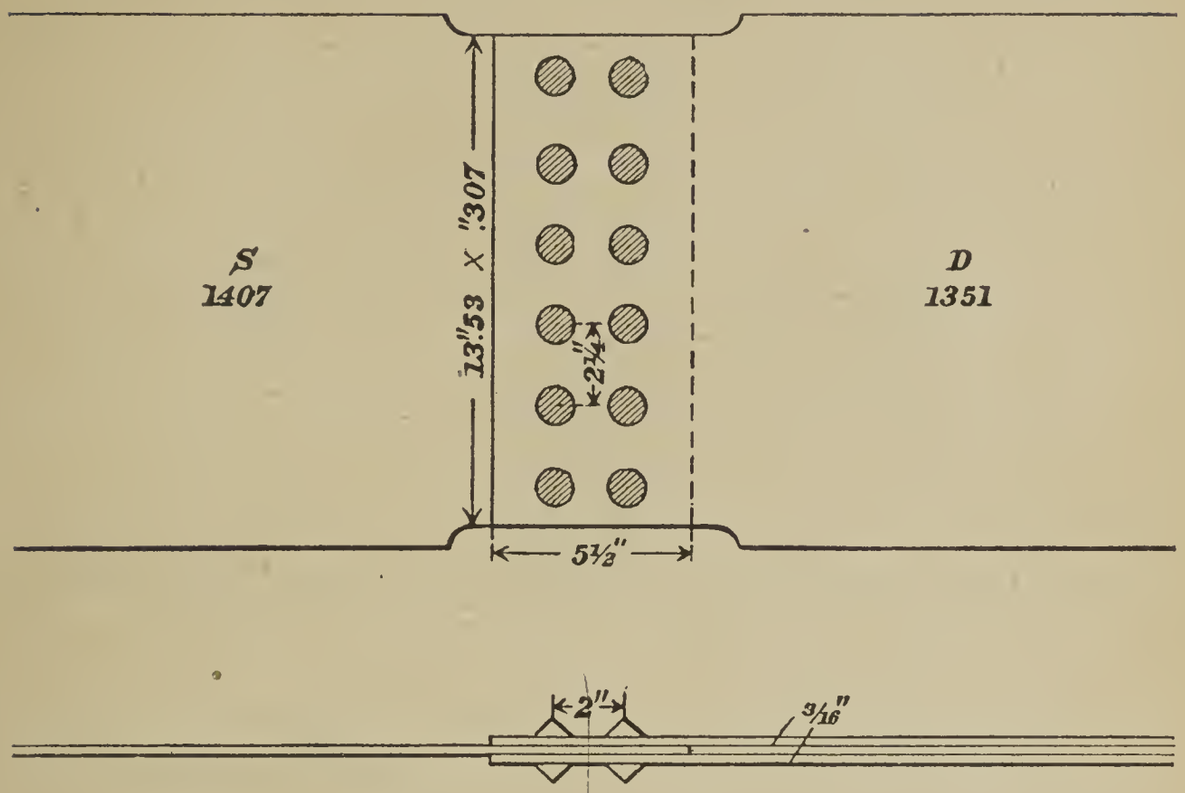
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	..	49,040
Tension on net section of plate	do	....	65,430
Compression on bearing surface of rivets	do	....	97,850
Shearing on rivets	do	....	38,140

Efficiency of joint, 86.4 per cent.

No. 5130.

($\frac{5}{16}$″ steel plate; $\frac{1}{2}$″ drilled holes; iron rivets, $2\frac{1}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.15
Plate, net sectional area	do	3.23
Plate, bearing surface of rivets	do	1.84
Rivets, shearing area	do	4.70

Tensile strength, 192,900 pounds.

Sheared the rivets.

Average elongation of rivet holes: First row, ″.23 each; second row, ″.04.

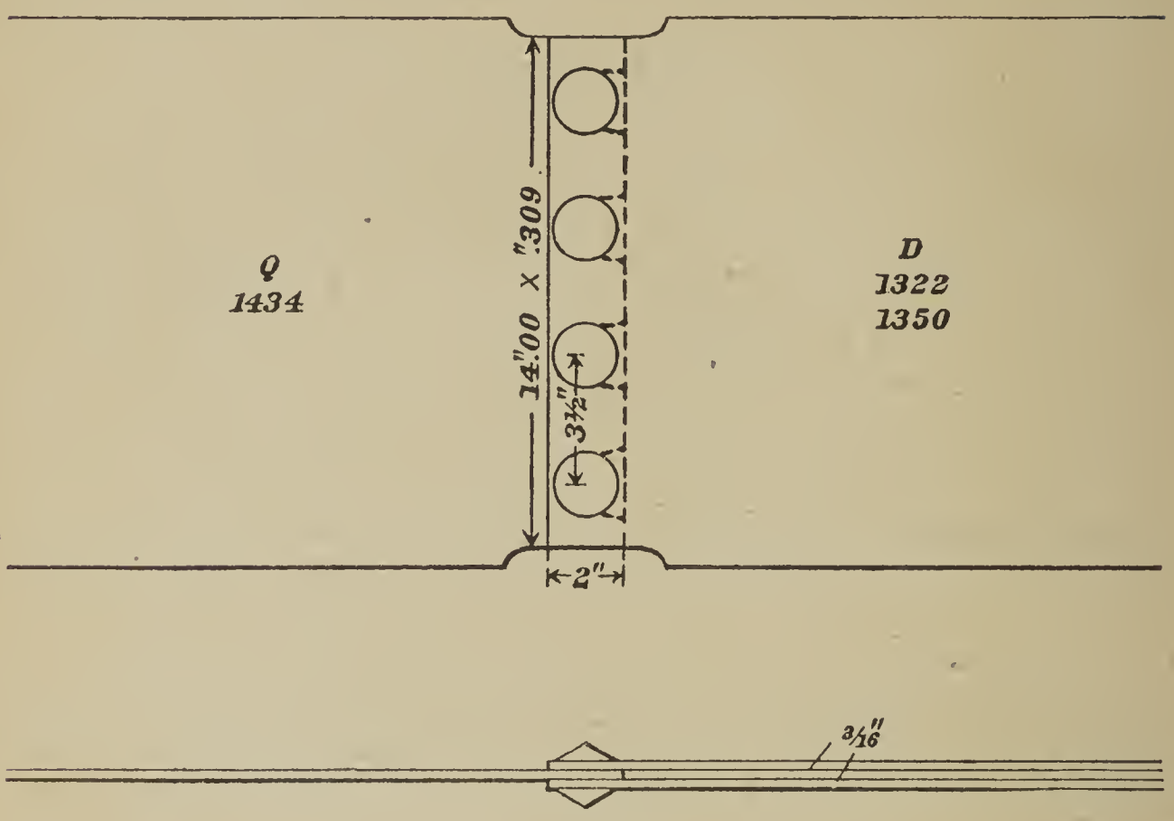
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,480
Tension on net section of plate	do	59,720
Compression on bearing surface of rivets	do	104,840
Shearing on rivets	do	41,040

Efficiency of joint, 81.5 per cent.

No. 4985.

($\frac{5}{16}$″ steel plate; 1″ drilled holes; iron rivets, $3\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.33
Plate, net sectional area	do	3.09
Plate, bearing surface of rivets	do	1.24
Rivets, shearing area	do	6.28

Tensile strength, 104,100 pounds.
Tore out plate in front of rivets.

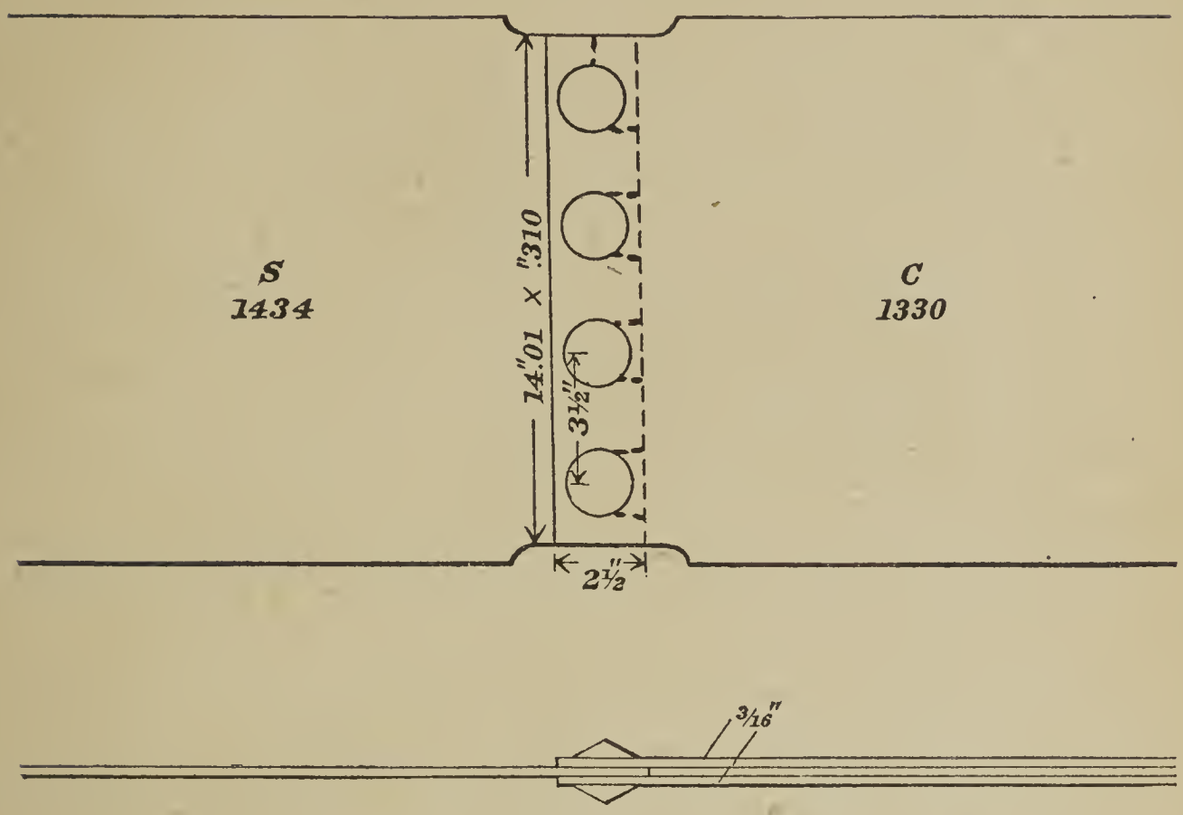
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	24,040
Tension on net section of plate	do	33,690
Compression on bearing surface of rivets	do	83,950
Shearing on rivets	do	16,580

Efficiency of joint, 42.3 per cent.

No. 4987.

($\frac{5}{16}$″ steel plate; 1″ drilled holes; iron rivets, 3½″ pitch.)



Areas.

Plate, gross sectional erea	square inches	4.34
Plate, net sectional area	do	3.10
Plate, bearing surface of rivets	do	1.24
Rivets, shearing area	do	6.28

Tensile strength, 116,200 pounds.
Tore out plate in front of rivets.

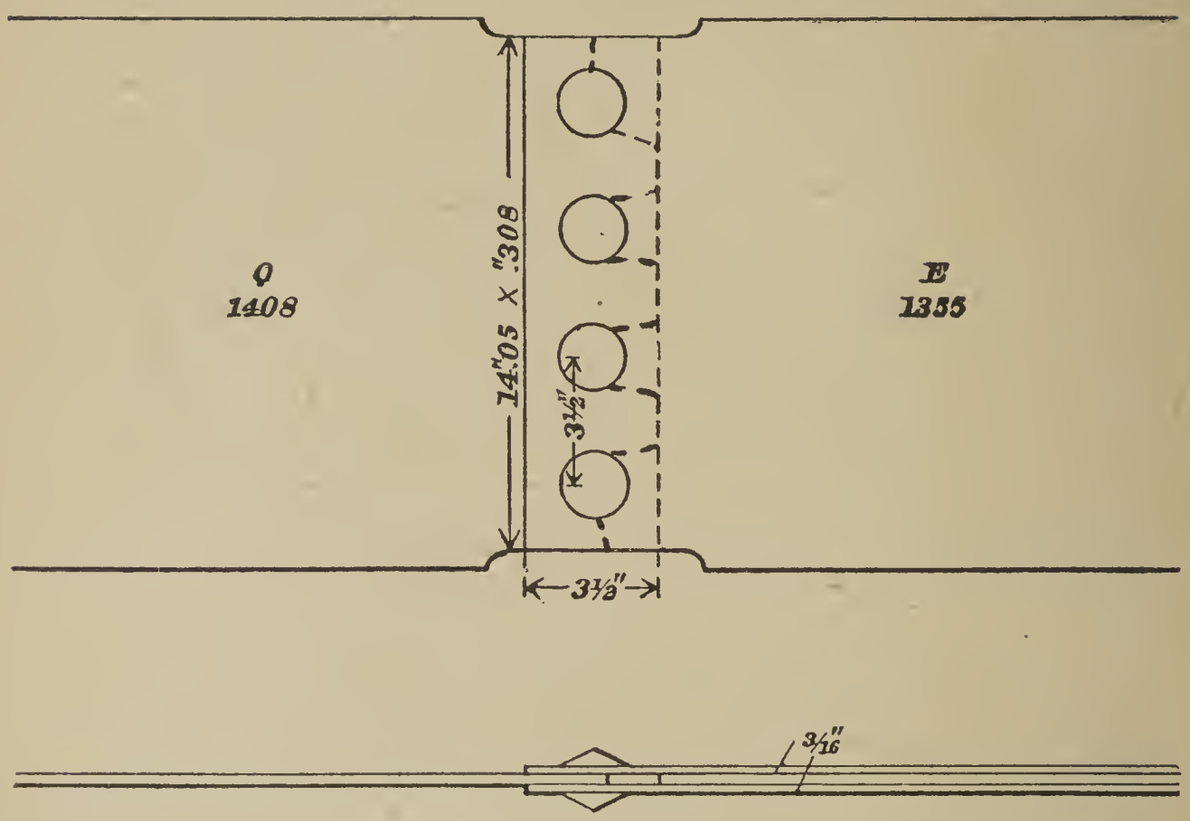
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	26,770
Tension on net section of plate	do	37,480
Compression on bearing surface of rivets	do	93,710
Shearing on rivets	do	18,500

Efficiency of joint, 46.9 per cent.

No. 4991.

($\frac{5}{16}$″ steel plate; 1″ drilled holes; iron rivets, 3½″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.33
Plate, net sectional area	do	3.10
Plate, bearing surface of rivets	do	1.23
Rivets, shearing area	do	6.28

Tensile strength, 146,980 pounds.
Tore out plate in front of rivets.

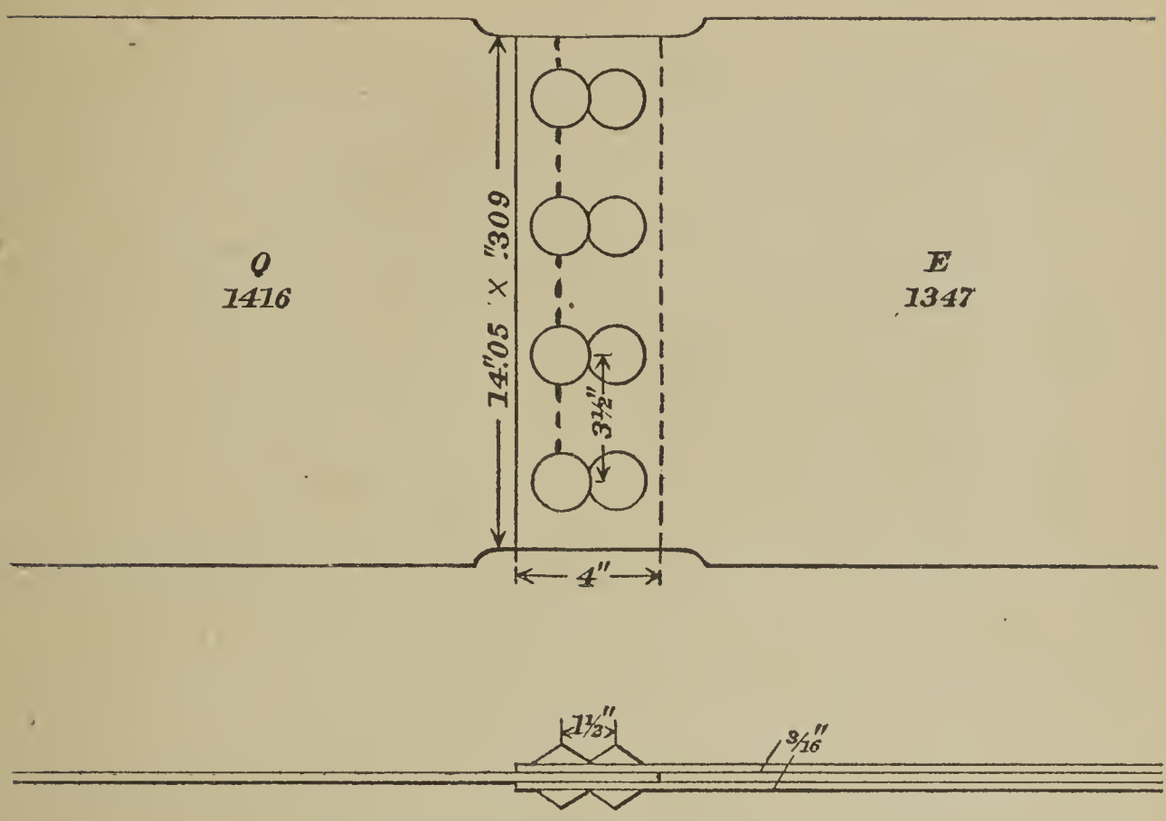
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	33,940
Tension on net section of plate	do	47,410
Compression on bearing surface of rivets	do	119,500
Shearing on rivets	do	23,400

Efficiency of joint, 59.8 per cent.

No. 4993.

($\frac{5}{16}$″ steel plate; 1″ drilled holes; iron rivets, $3\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.34
Plate, net sectional area	do	3.11
Plate, bearing surface of rivets	do	2.47
Rivets, shearing area	do	12.57

Tensile strength, 194,150 pounds.
Fractured plate along first row of rivet holes. Appearance, silky.

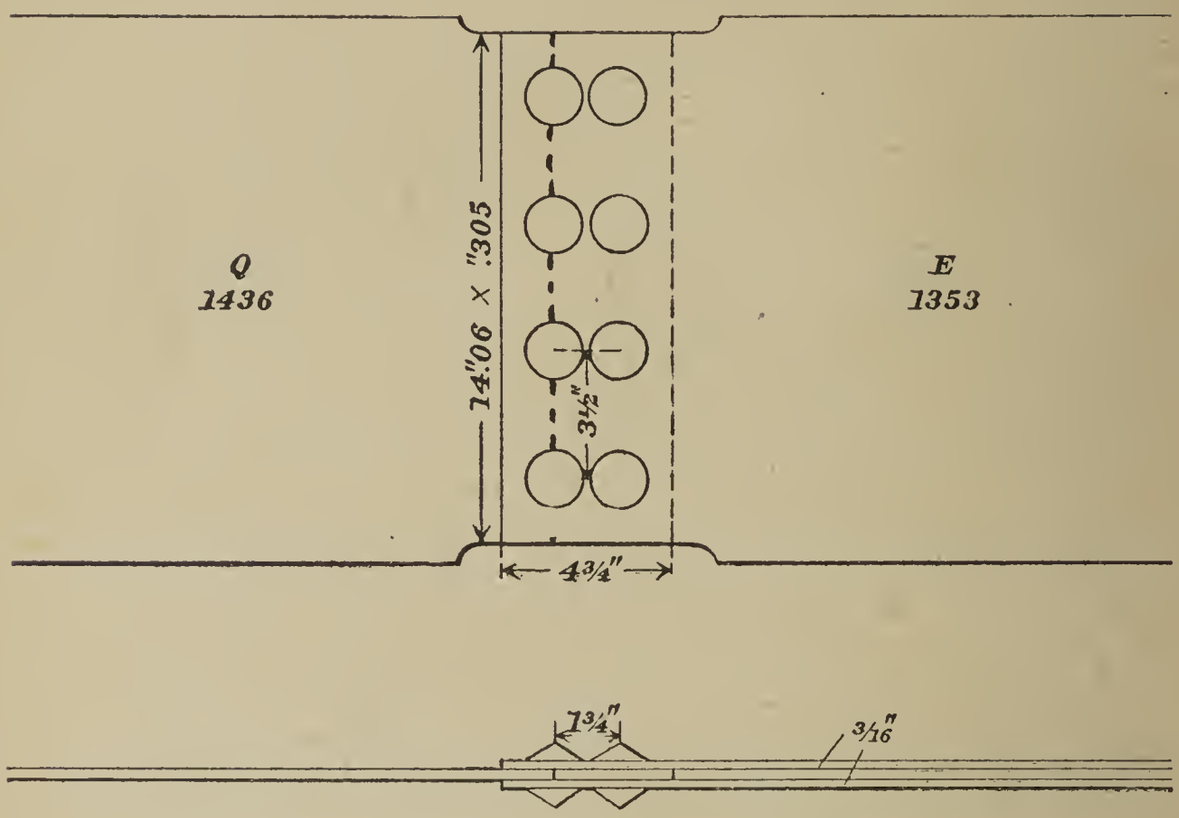
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	44,740
Tension on net section of plate	do	62,430
Compression on bearing surface of rivets	do	78,600
Shearing on rivets	do	15,450

Efficiency of joint, 78.8 per cent.

No. 4995.

($\frac{5}{16}$″ steel plate; 1″ drilled holes; iron rivets, $3\frac{1}{2}$″ pitch.)



Areas.

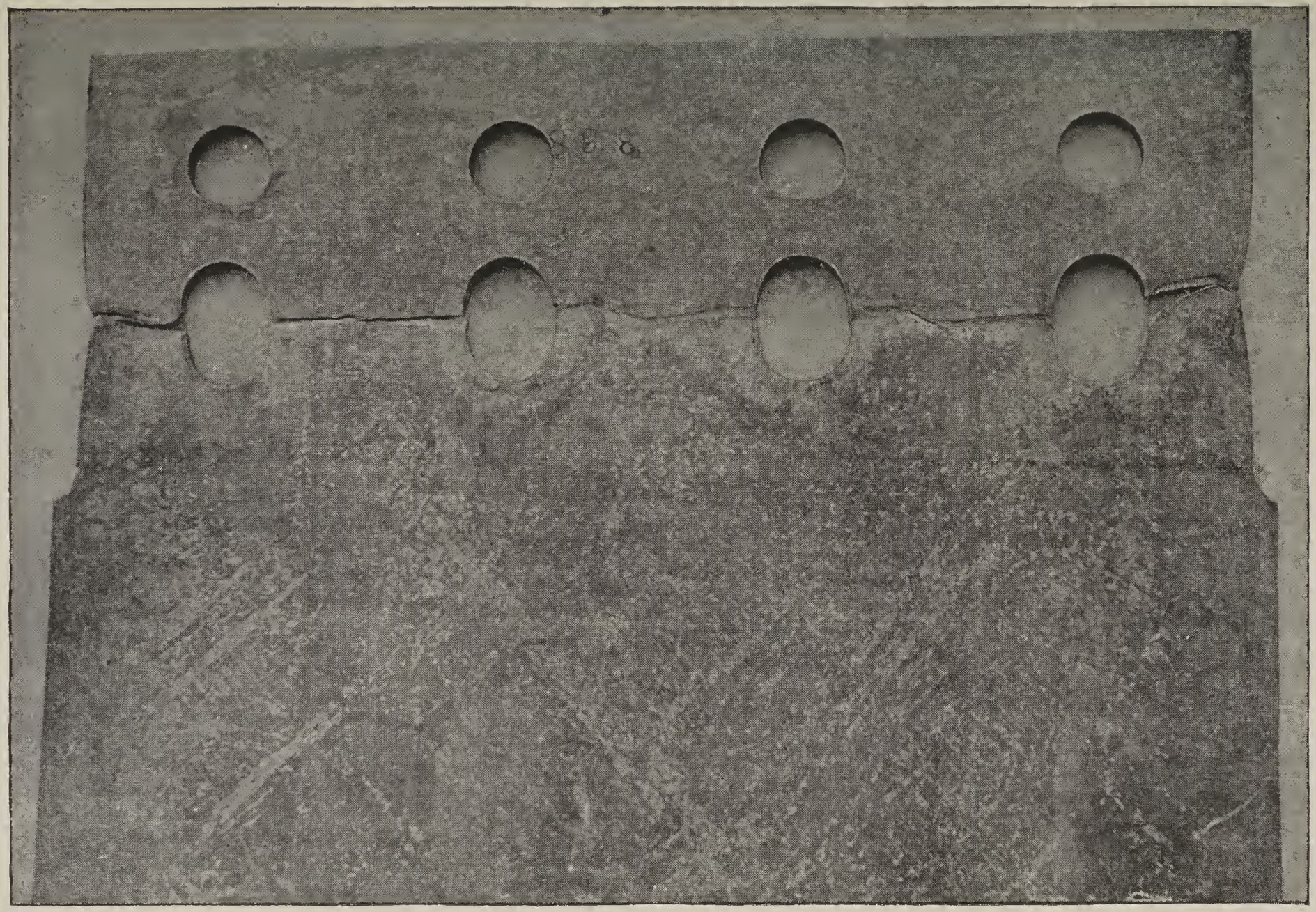
Plate, gross sectional area	square inches	4.29
Plate, net sectional area	do	3.07
Plate, bearing surface of rivets	do	2.44
Rivets, shearing area	do	12.57

Tensile strength, 195,150 pounds.
Fractured plate along first row of rivet holes. Appearance, silky.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	45,490
Tension on net section of plate	do	63,570
Compression on bearing surface of rivets	do	79,980
Shearing on rivets	do	15,536

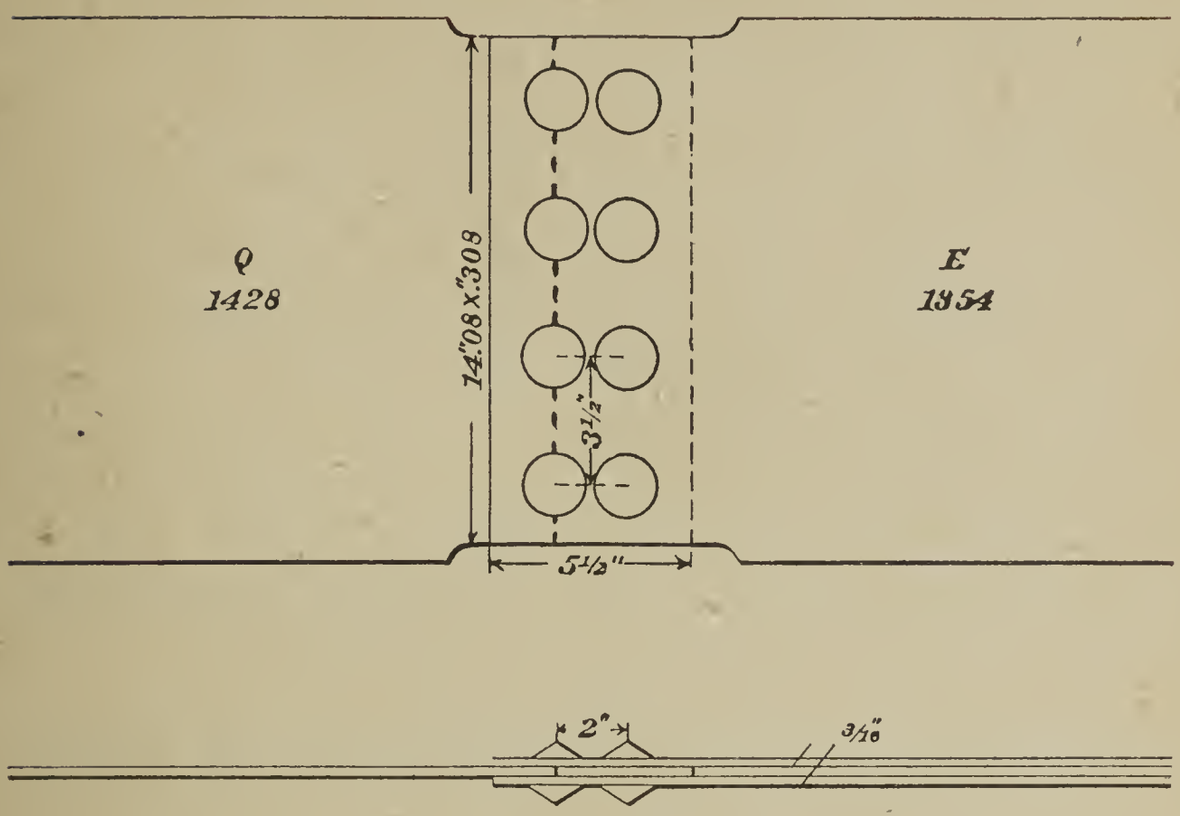
Efficiency of joint, 80.1 per cent.



No. 4995.

No 4997.

($\frac{5}{16}$″ steel plate; 1″ drilled holes; iron rivets, 3½″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.34
Plate, net sectional area	do	3.10
Plate, bearing surface of rivets	do	2.46
Rivets, shearing area	do	12.57

Tensile strength, 197,600 pounds.

Fractured plate along first row of rivet holes. Appearance, silky. Average elongation of rivet holes in plate: First row, ″.33*; second row was distorted but not elongated in direction of pull.

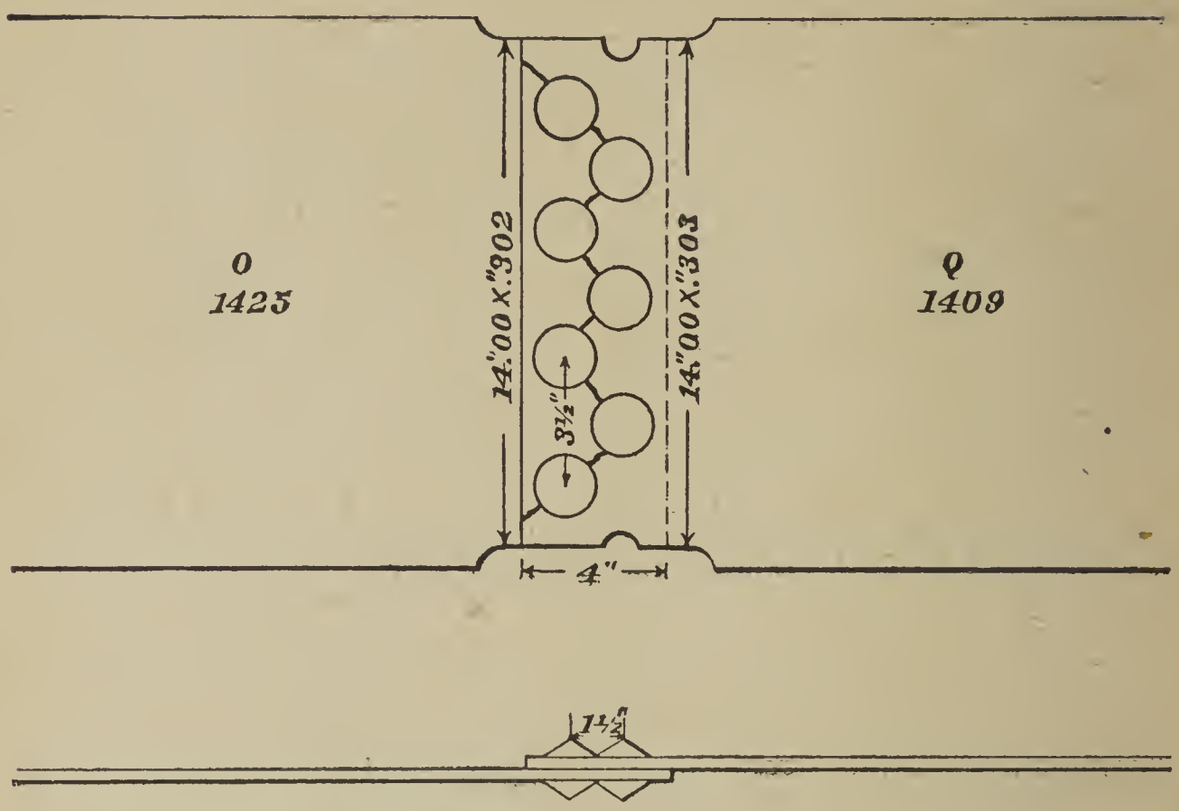
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	45,530
Tension on net section of plate	do	63,740
Compression on bearing surface of rivets	do	80,330
Shearing on rivets	do	15,720

Efficiency of joint, 80.2 per cent.

No. 5119.

($\frac{5}{16}$″ steel plate; 1″ drilled holes; iron rivets, $3\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.24
Plate, net sectional area	do	3.03
Plate, bearing surface of rivets	do	2.12
Rivets, shearing area	do	5.50

Tensile strength, 181,280 pounds.

Fractured plate Q taking zigzag course from rivet hole to rivet hole of each row.

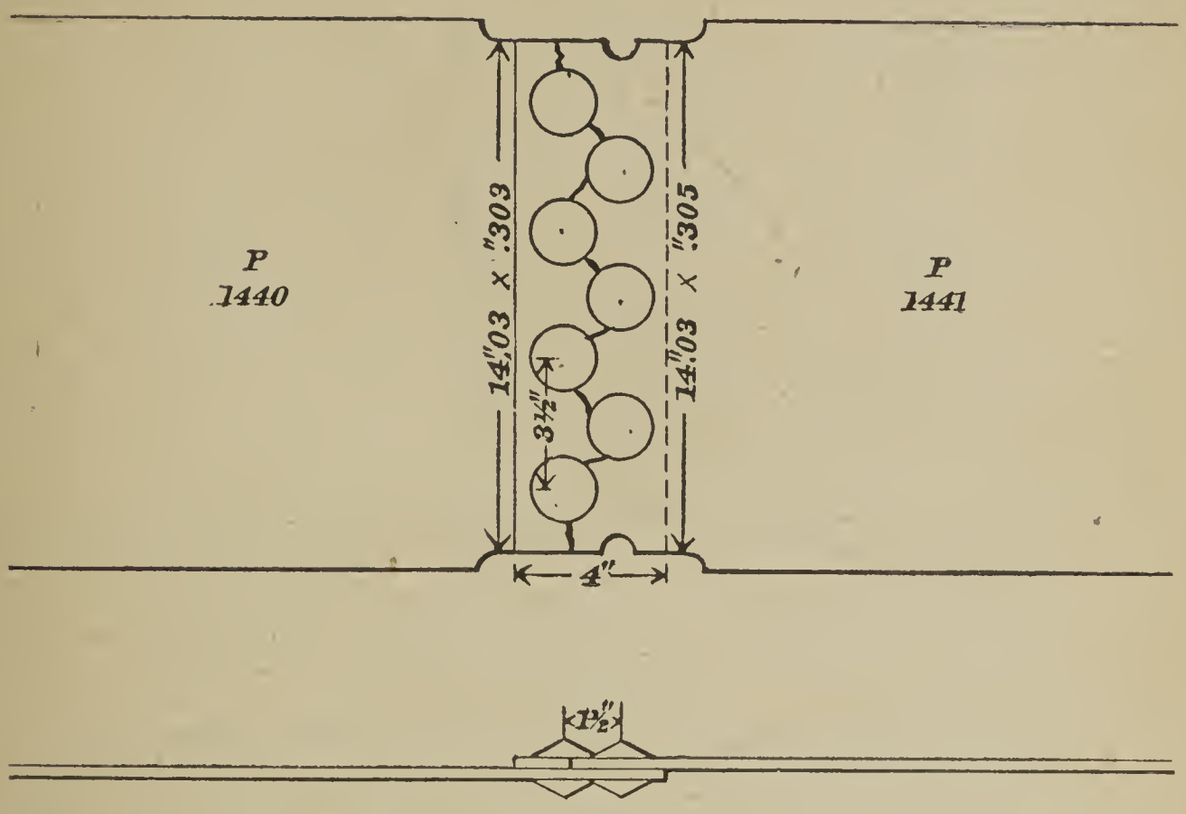
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,750
Tension on net section of plate	do	59,830
Compression on bearing surface of rivets	do	85,510
Shearing on rivets	do	32,960

Efficiency of joint, 75.3 per cent.

No. 5120.

($\frac{5}{16}$″ steel plate; punched holes, punch 1″, die, $1\frac{1}{16}$″; iron rivets, $3\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.28
Plate, net sectional area	do	3.02
Plate, bearing surface of rivets	do	2.20
Rivets, shearing area	do	5.50

Tensile strength, 173,900 pounds.

Fractured along a zigzag course from rivet hole to rivet hole of each row.

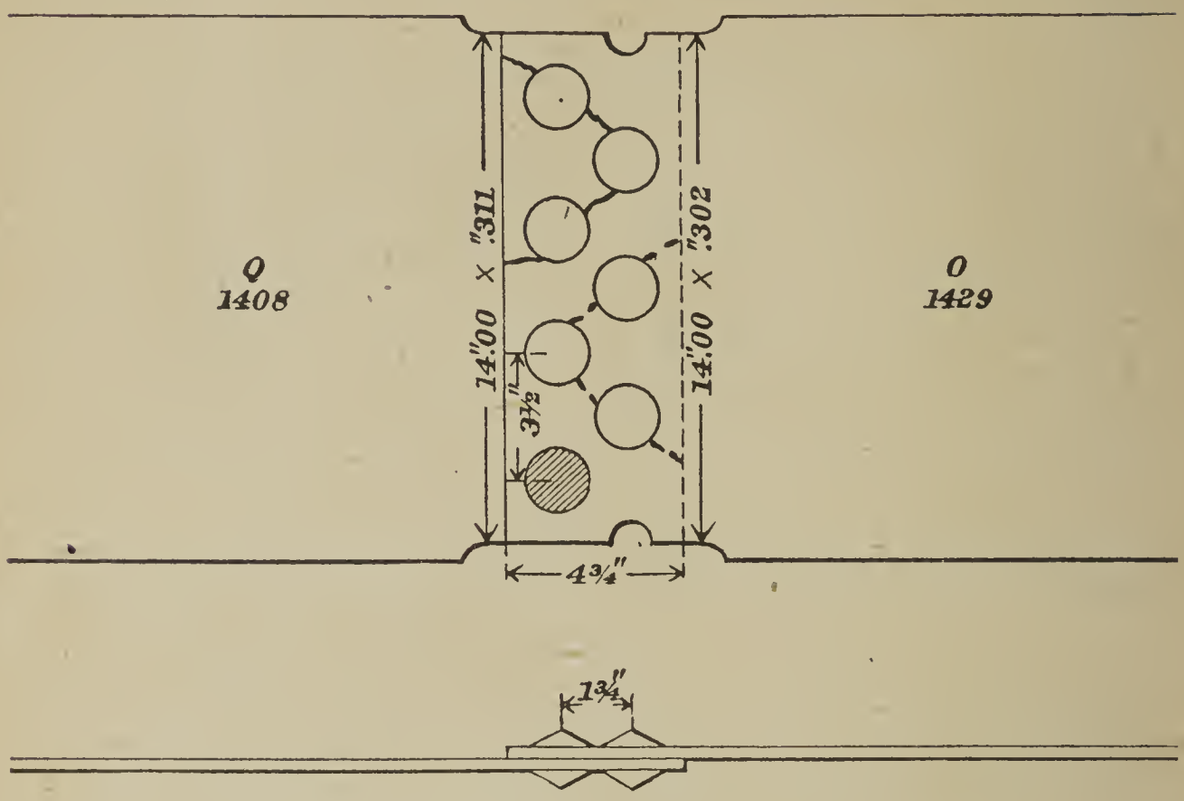
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	40,630
Tension on net section of plate	do	57,580
Compression on bearing surface of rivets	do	79,050
Shearing on rivets	do	31,620

Efficiency of joint, 68.5 per cent.

No. 5121.

($\frac{5}{16}$″ steel plate; 1″ drilled holes; iron rivets, $3\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.23
Plate, net sectional area	do	3.02
Plate, bearing surface of rivets	do	2.11
Rivets, shearing area	do	5.50

Tensile strength, 181,850 pounds.
Sheared one rivet and tore out parts of both plates.

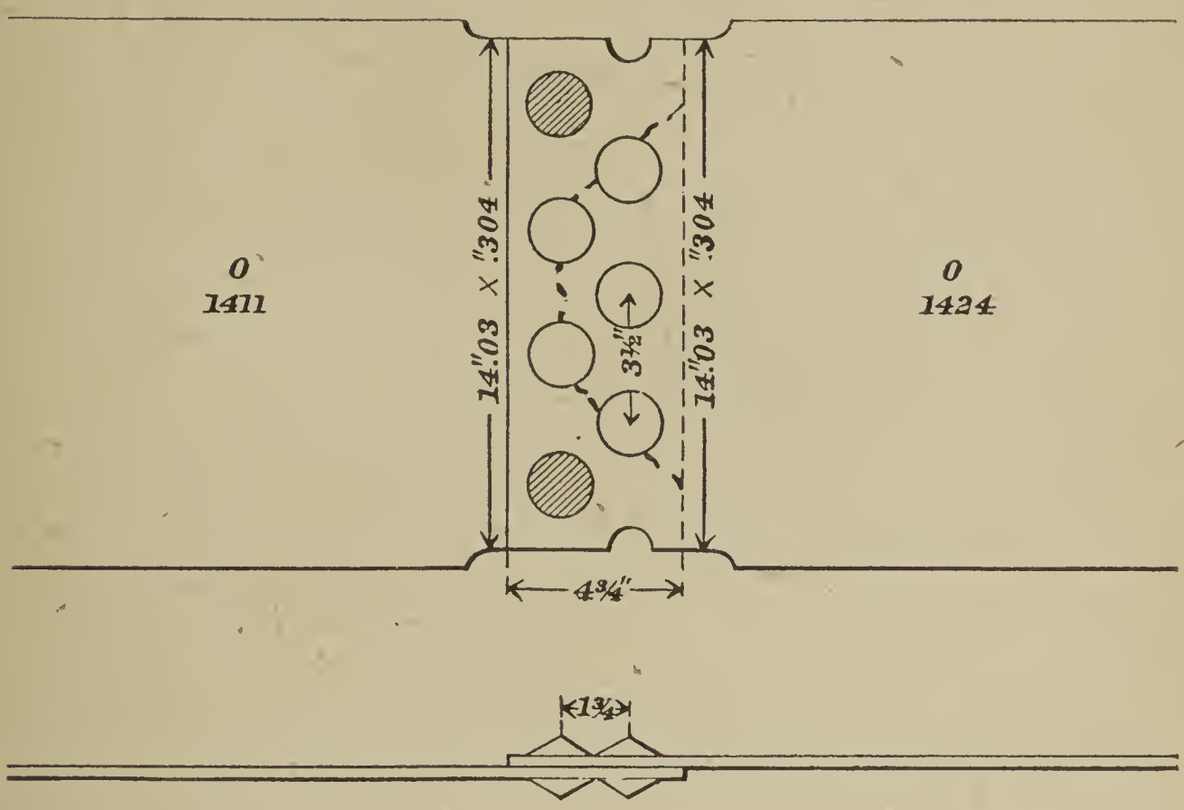
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,990
Tension on net section of plate	do	60,220
Compression on bearing surface of rivets	do	86,180
Shearing on rivets	do	33,060

Efficiency of joint, 79.1 per cent.

No. 5122.

($\frac{5}{16}$″ steel plate; punched holes, punch 1″; die, $1\frac{1}{16}$″; iron rivets, $3\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.27
Plate, net sectional area	do	3.01
Plate, bearing surface of rivets	do	2.19
Rivets, shearing area	do	5.50

Tensile strength, 189,320 pounds.

Sheared two rivets, fractured one section of plate, and tore out through second row of rivet holes to the end of the plate.

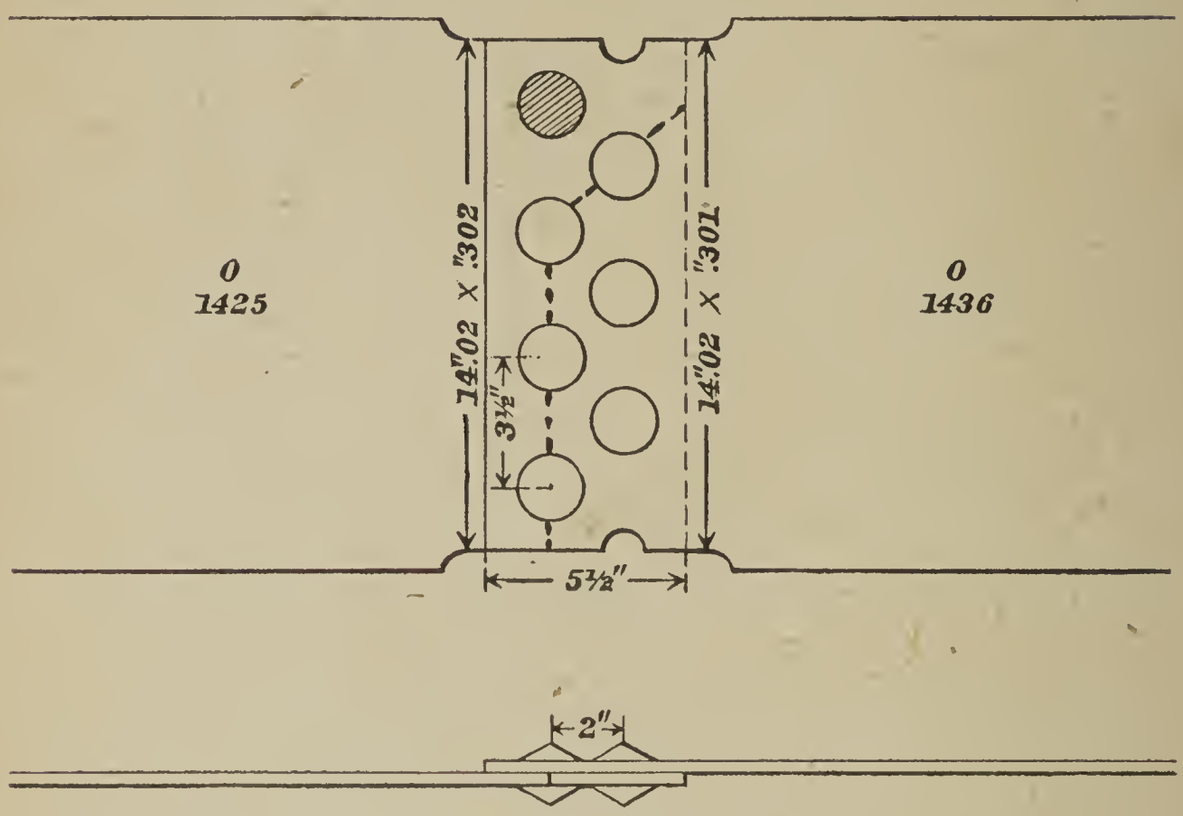
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	44,340
Tension on net section of plate	do	62,900
Compression on bearing surface of rivets	do	86,450
Shearing on rivets	do	34,420

Efficiency of joint, 81.6 per cent.

No. 5123.

($\frac{5}{16}$″ steel plate; 1″ drilled holes; iron rivets, 3½″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.23
Plate, net sectional area	do	3.02
Plate, bearing surface of rivets	do	2.11
Rivets, shearing area	do	5.50

Tensile strength, 189,800 pounds.

Sheared one rivet, pulled heads off two others, and fractured the plate.

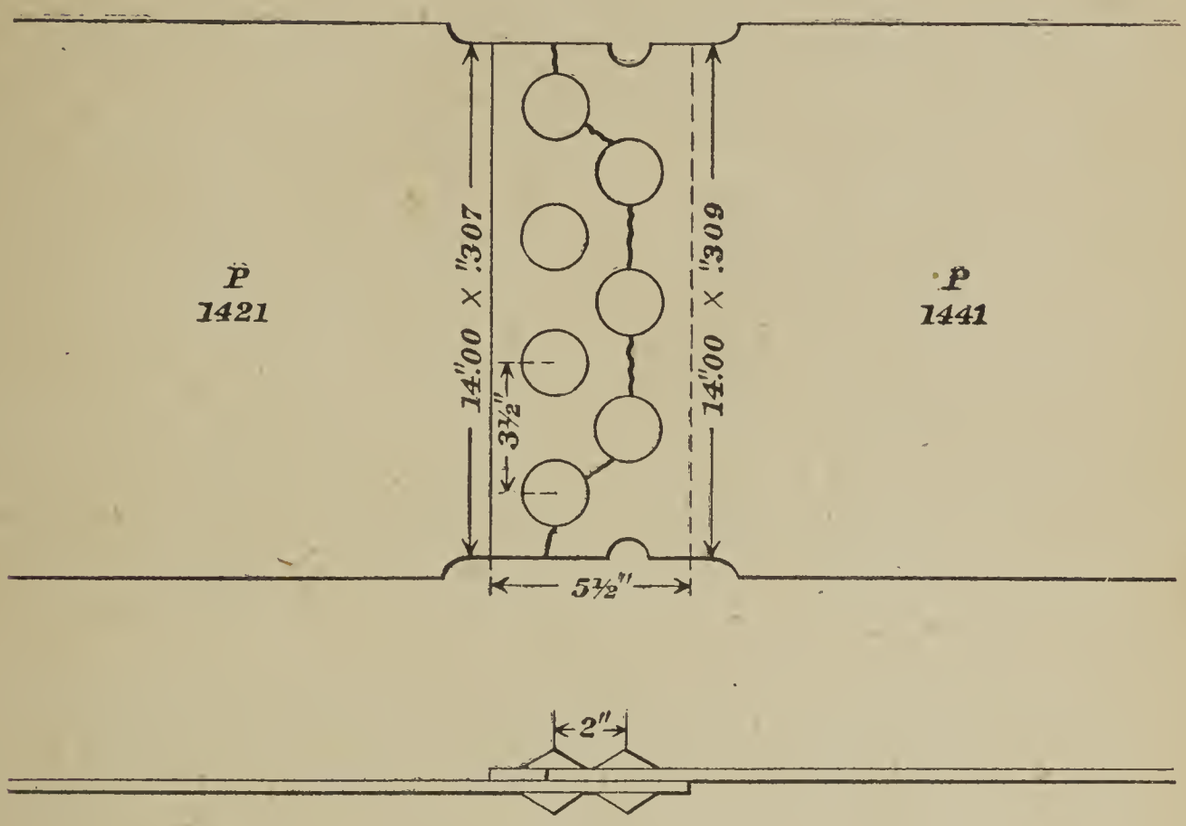
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	44,870
Tension on net section of plate	do	62,850
Compression on bearing surface of rivets	do	89,950
Shearing on rivets	do	34,510

Efficiency of joint, 82.5 per cent.

No. 5124.

($\frac{5}{16}$″ steel plate; punched holes, punch, 1″; die, $1\frac{1}{16}$″; iron rivets, $3\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.33
Plate, net sectional area	do	3.03
Plate, bearing surface of rivets	do	2.22
Rivets, shearing area	do	5.50

Tensile strength, 188,300 pounds.

Fractured plate across two sections between rivets, then tearing through to second row of rivet holes. Appearance, silky.

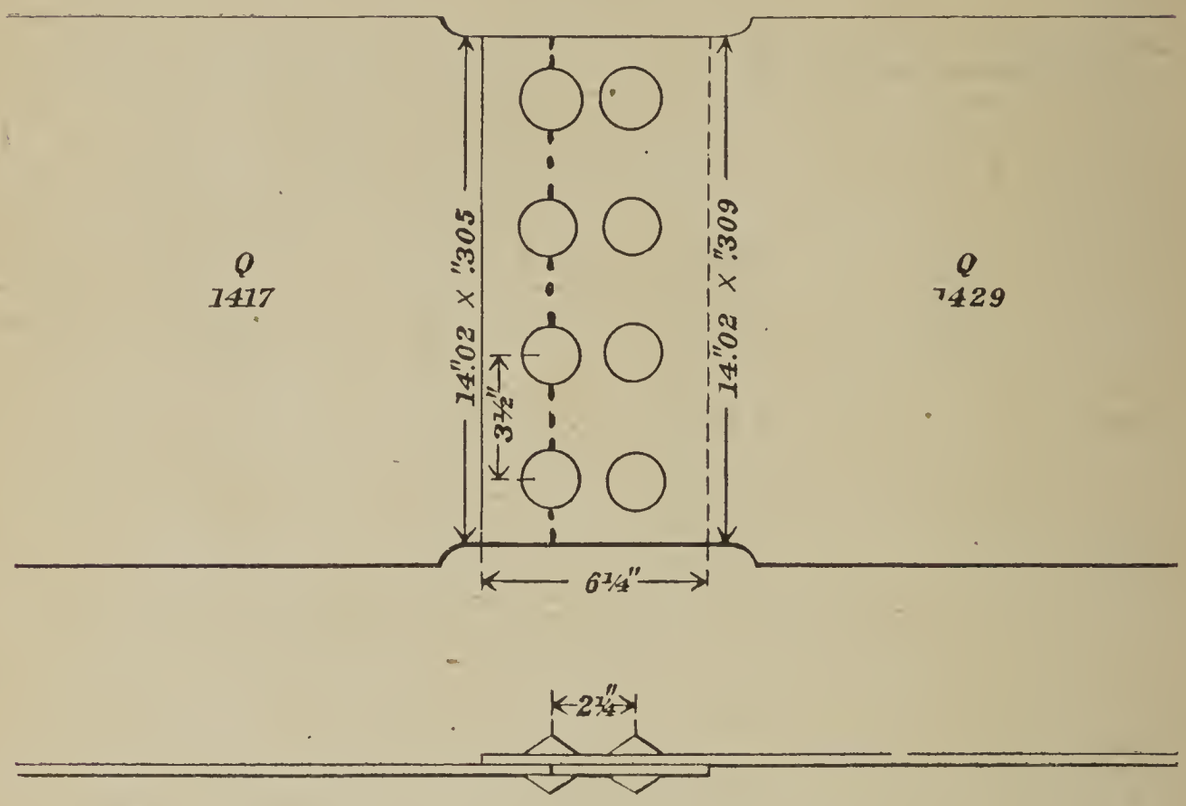
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	43,490
Tension on net section of plate	do	62,150
Compression on bearing surface of rivets	do	84,820
Shearing on rivets	do	34,240

Efficiency of joint, 73.3 per cent.

No. 4999.

($\frac{5}{16}$″ steel plate; 1″ drilled holes; iron rivets, 3½″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.28
Plate, net sectional area	do	3.06
Plate, bearing surface of rivets	do	2.44
Rivets, shearing area	do	6.28

Tensile strength, 197,200 pounds.

Fractured plate O 1417 along first row of rivet holes. Appearance, silky.

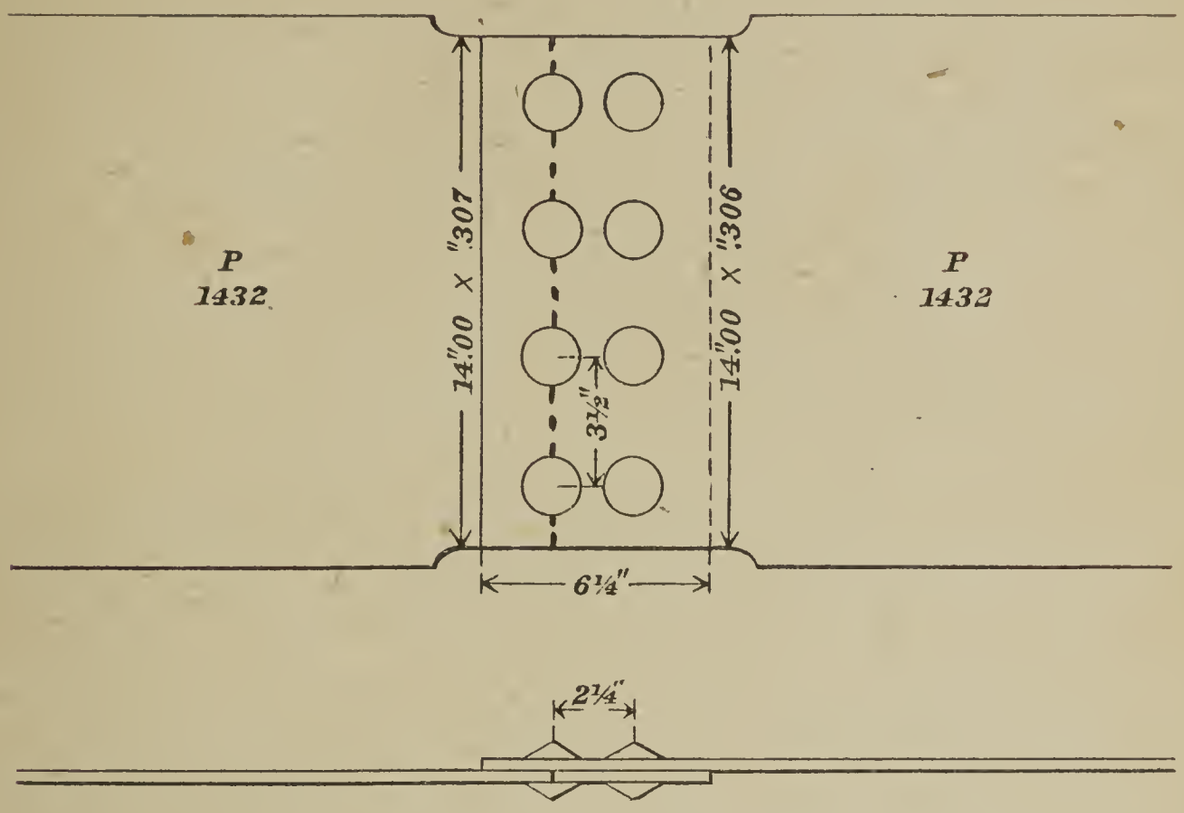
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,070
Tension on net section of plate	do	64,440
Compression on bearing surface of rivets	do	80,820
Shearing on rivets	do	31,400

Efficiency of joint, 80.1 per cent.

No. 5000.

($\frac{5}{16}$″ steel plate; punched holes, punch, 1″; die, $1\frac{1}{16}$″; iron rivets, $3\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.28
Plate, net sectional area	do	3.03
Plate, bearing surface of rivets	do	2.53
Rivets, shearing area	do	6.28

Tensile strength, 188,150 pounds.

Fractured plate along first row of rivet holes. Appearance, silky. Average elongation of rivet holes: Fractured plate, ″.40, ″.00; plate not fractured, ″.15, ″.00.

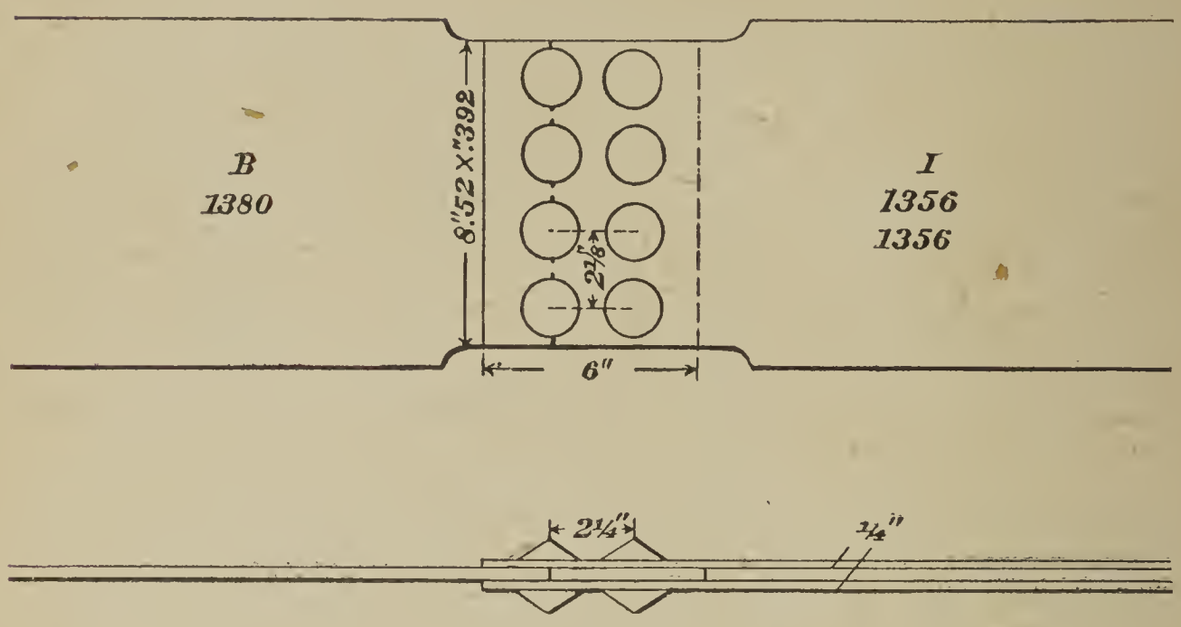
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	43,960
Tension on net section of plate	do	62,100
Compression on bearing surface of rivets	do	74,370
Shearing on rivets	do	29,960

Efficiency of joint, 74.1 per cent.

No. 4951.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ drilled holes, iron rivets, $2\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.34
Plate, net sectional area	do	2.16
Plate, bearing surface of rivets	do	2.35
Rivets, shearing area	do	7.07

Tensile strength, 144,580 pounds.

Fractured plate along first row of rivet holes. Appearance, silky.

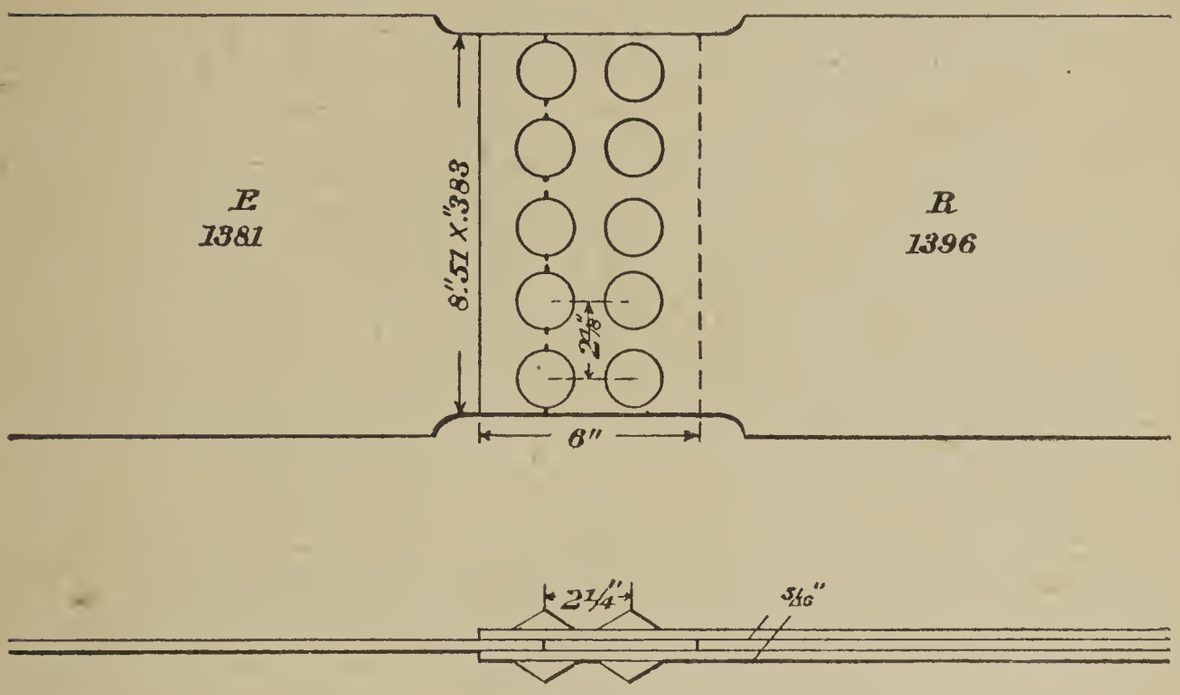
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	43,290
Tension on net section of plate	do	66,940
Compression on bearing surface of rivets	do	61,520
Shearing on rivets	do	20,450

Efficiency of joint, 72.4 per cent.

No. 4952.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ drilled holes; iron rivets, $2\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.26
Plate, net sectional area	do	2.11
Plate, bearing surface of rivets	do	2.30
Rivets, shearing area	do	7.07

Tensile strength, 138,150 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, lamellar.

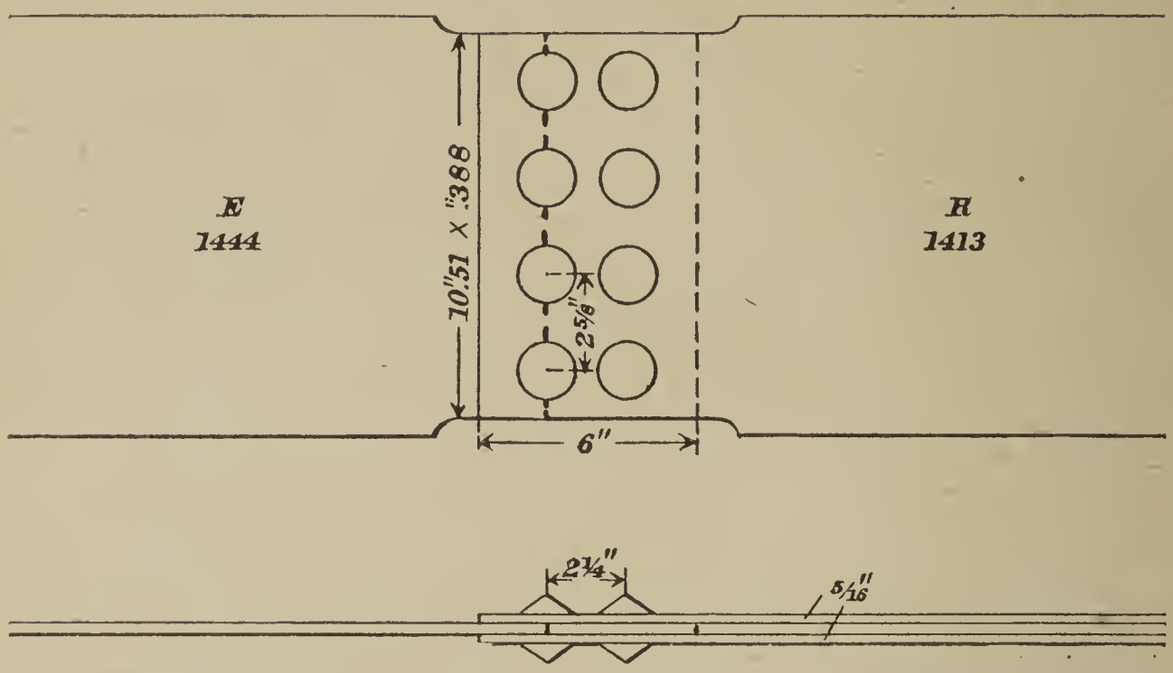
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,380
Tension on net section of plate	do	65,470
Compression on bearing surface of rivets	do	60,070
Shearing on rivets	do	19,540

Efficiency of joint, 72.6 per cent.

No. 4953.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ inch drilled holes; iron rivets, $2\frac{5}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	..	4.08
Plate, net sectional area	do	....	2.91
Plate, bearing surface of rivets	do	....	2.33
Rivets, shearing area	do	....	7.07

Tensile strength, 190,100 pounds.

Fractured plate across first row of rivet holes. Appearance, silky, lamellar.

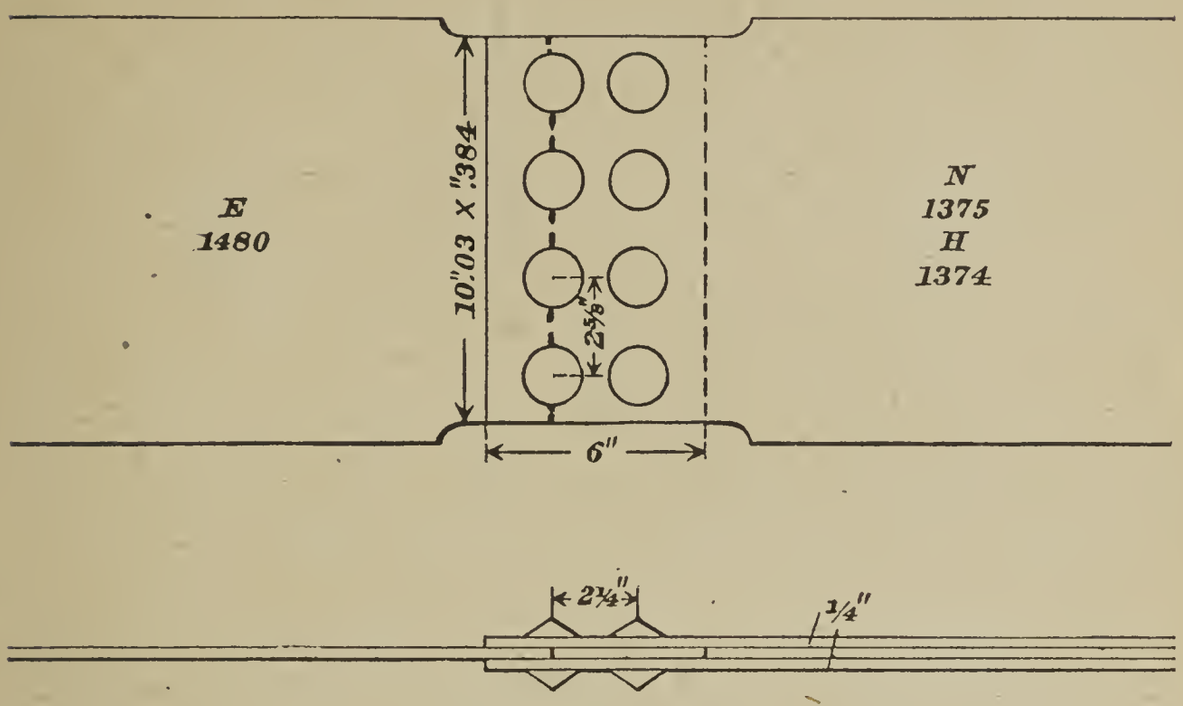
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	..	46,590
Tension on net section of plate	do	....	65,330
Compression on bearing surface of rivets	do	....	81,590
Shearing on rivets	do	....	26,890

Efficiency of joint, 79.8 per cent.

No. 4954.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ drilled holes; iron rivets, $2\frac{5}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	3.85
Plate, net sectional area	do	2.70
Plate, bearing surface of rivets	do	2.30
Rivets, shearing area	do	7.07

Tensile strength, 189,150 pounds.

Fractured plate across first row of rivet holes. Appearance, silky, lamellar.

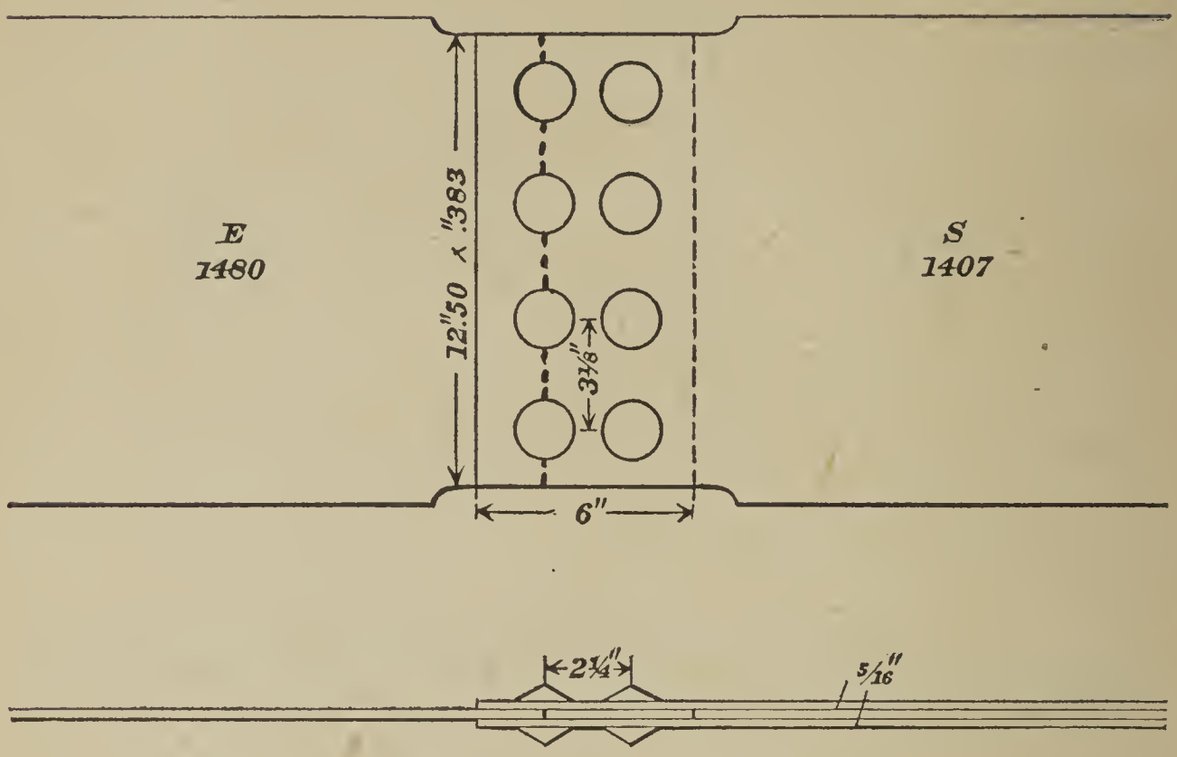
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	49,130
Tension on net section of plate	do	70,060
Compression on bearing surface of rivets	do	82,240
Shearing on rivets	do	26,750

Efficiency of joint, 84.2 per cent.

No. 4955.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ drilled holes; iron rivets, $3\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.79
Plate, net sectional area	do	3.64
Plate, bearing surface of rivets	do	2.30
Rivets, shearing area	do	7.07

Tensile strength, 232,860 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, lamellar.

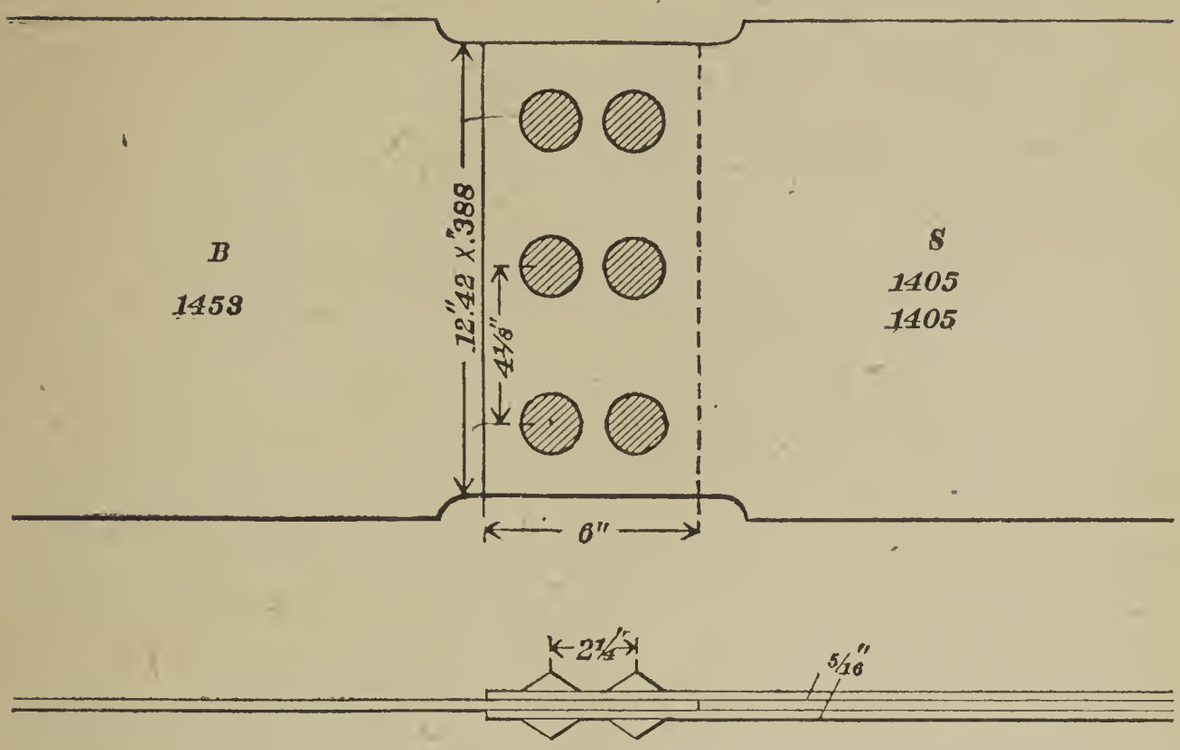
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	48,610
Tension on net section of plate	do	63,970
Compression on bearing surface of rivets	do	101,250
Shearing on rivets	do	32,940

Efficiency of joint, 83.3 per cent.

No. 4959.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ drilled holes; iron rivets, $4\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.82
Plate, net sectional area	do	3.95
Plate, bearing surface of rivets	do	1.75
Rivets, shearing area	do	5.30

Tensile strength, 207,600 pounds.

Sheared the rivets.

Elongation of rivet holes: First row, ″.19, ″.27, ″.31; second row, ″.11, ″.17, ″.11.

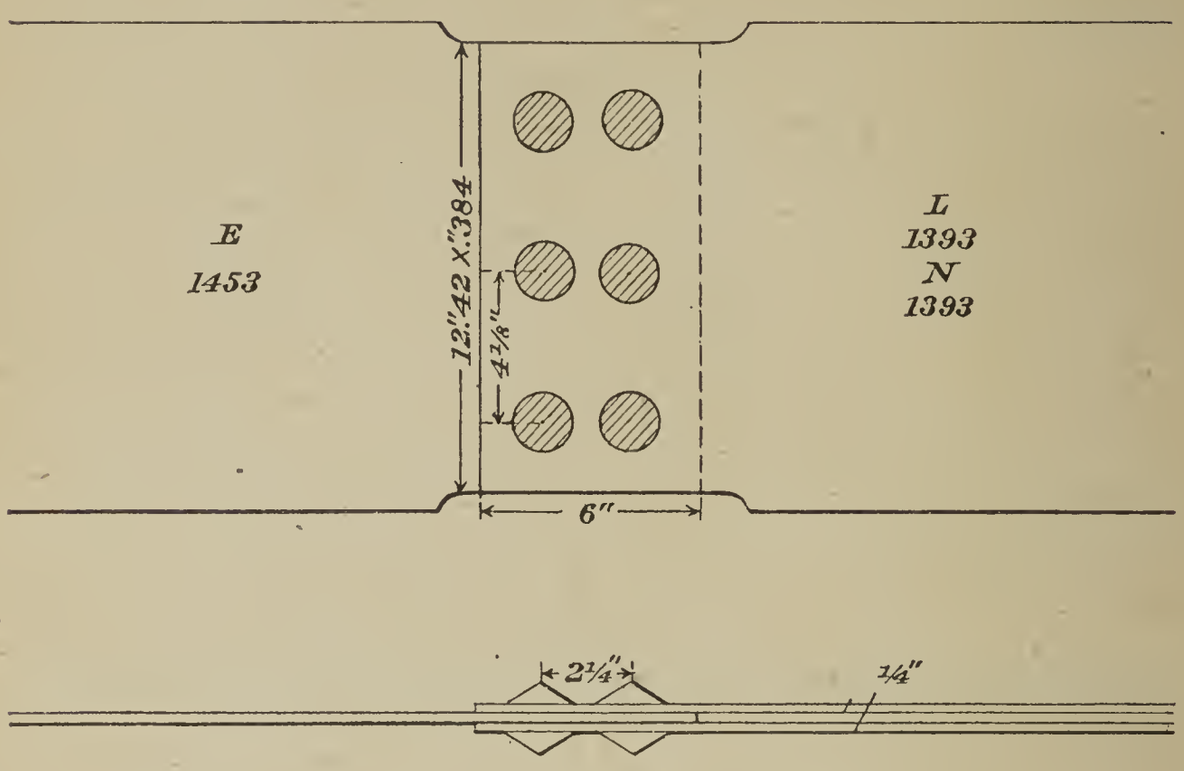
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	43,070
Tension on net section of plate	do	52,560
Compression on bearing surface of rivets	do	118,630
Shearing on rivets	do	39,170

Efficiency of joint, 72.1 per cent.

No. 4960.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ drilled holes; iron rivets, $4\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.77
Plate, net sectional area	do	3.91
Plate, bearing surface of rivets	do	1.73
Rivets, shearing area	do	5.30

Tensile strength, 202,800 pounds.

Sheared the rivets.

Elongation of rivet holes: First row, ″.20, ″.25, ″.27; second row, ″.10, ″.13, ″.13.

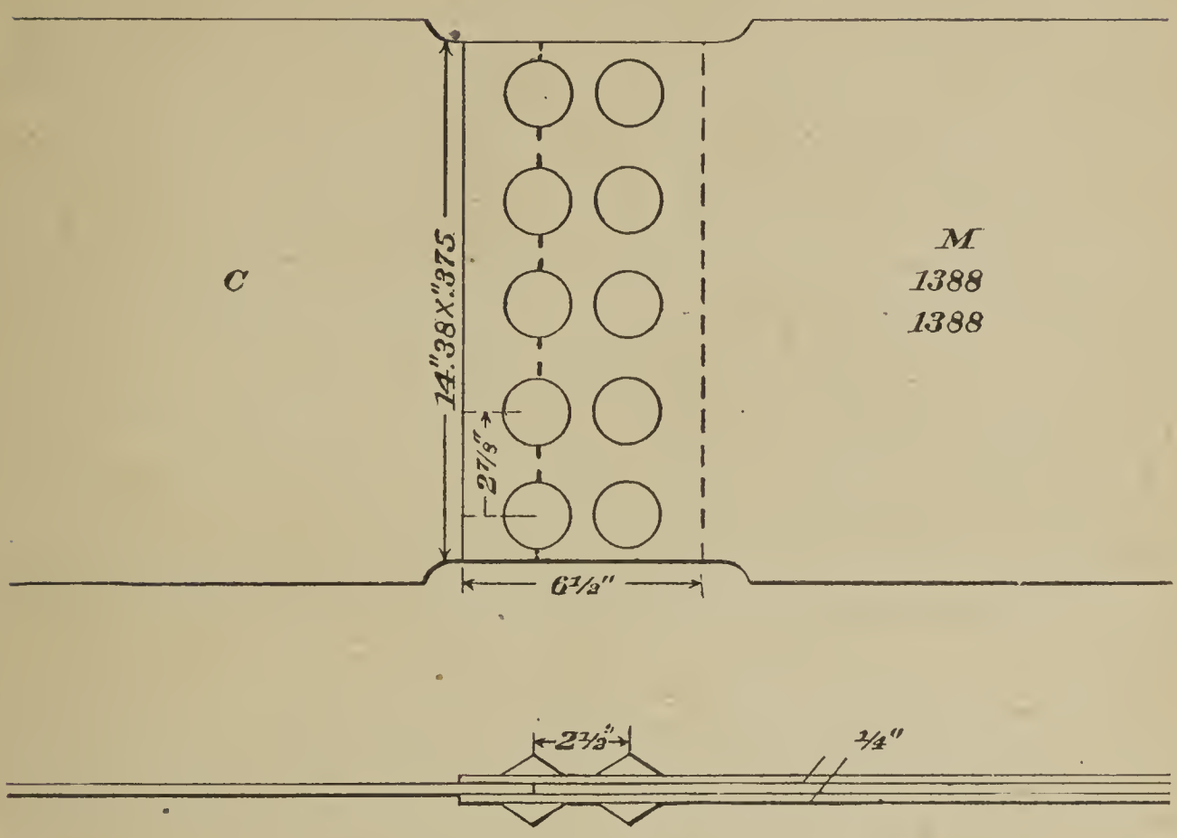
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,520
Tension on net section of plate	do	51,870
Compression on bearing surface of rivets	do	117,230
Shearing on rivets	do	38,260

Efficiency of joint, 72.8 per cent.

No. 4967.

($\frac{3}{8}$″ steel plate; 1″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.39
Plate, net sectional area	do	3.52
Plate, bearing surface of rivets	do	3.75
Rivets, shearing area	do	15.71

Tensile strength, 231,200 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, lamellar.

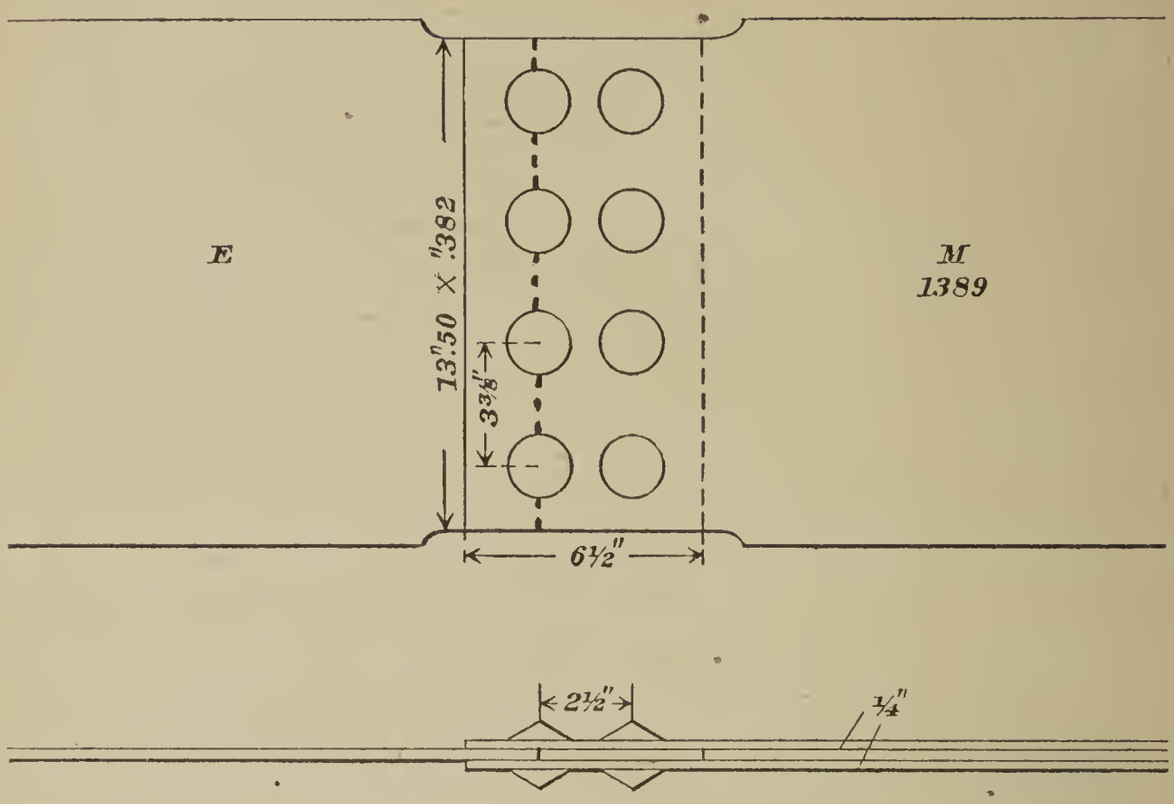
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,890
Tension on net section of plate	do	65,680
Compression on bearing surface of rivets	do	61,650
Shearing on rivets	do	14,720

Efficiency of joint, 74.1 per cent.

No. 4969.

($\frac{3}{8}$″ steel plate; 1″ drilled holes; iron rivets, $3\frac{3}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.16
Plate, net sectional area	do	3.63
Plate, bearing surface of rivets	do	3.06
Rivets, shearing area	do	12.57

Tensile strength, 228,400 pounds.

Fractured plate along first row of rivet holes. Appearance, silky.

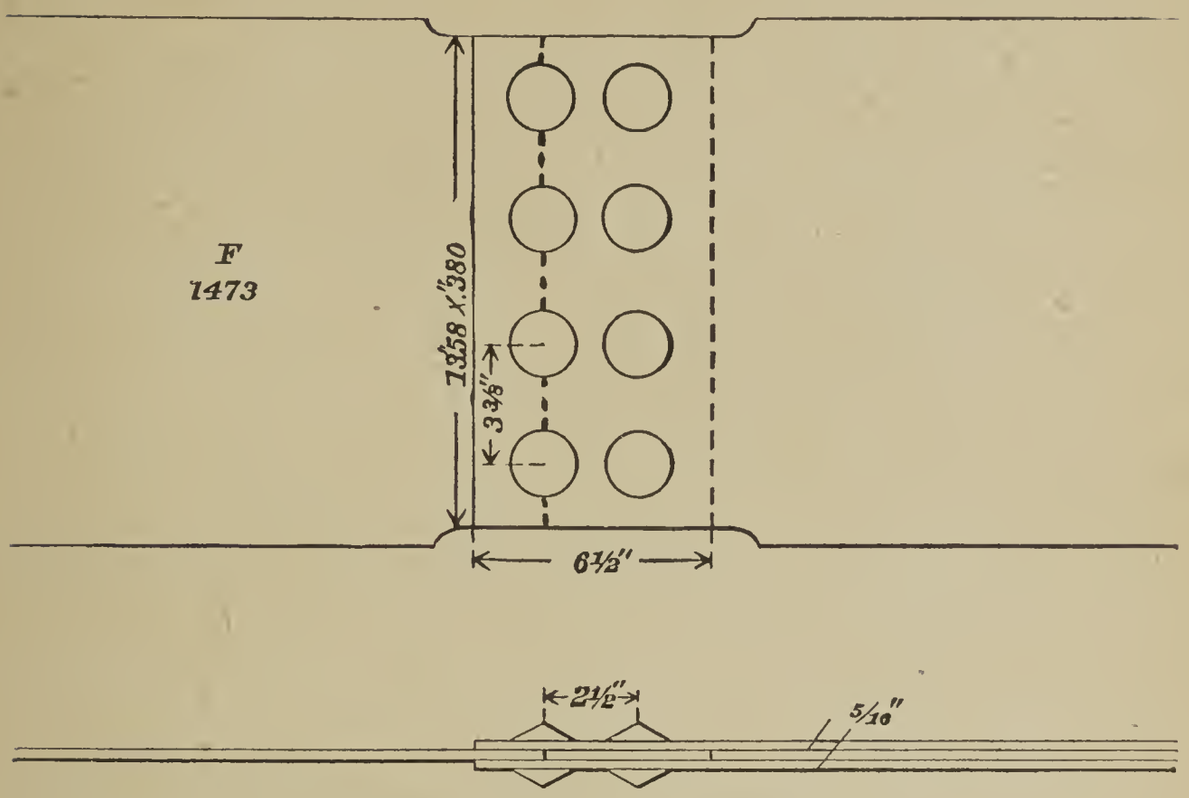
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	44,260
Tension on net section of plate	do	62,920
Compression on bearing surface of rivets	do	74,640
Shearing on rivets	do	18,170

Efficiency of joint, 75.9 per cent.

No. 4970.

($\frac{3}{8}$″ steel plate; 1″ drilled holes; iron rivets, $3\frac{3}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.16
Plate, net sectional area	do	3.64
Plate, bearing surface of rivets	do	3.04
Rivets, shearing area	do	12.57

Tensile strength, 223,100 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, lamellar.

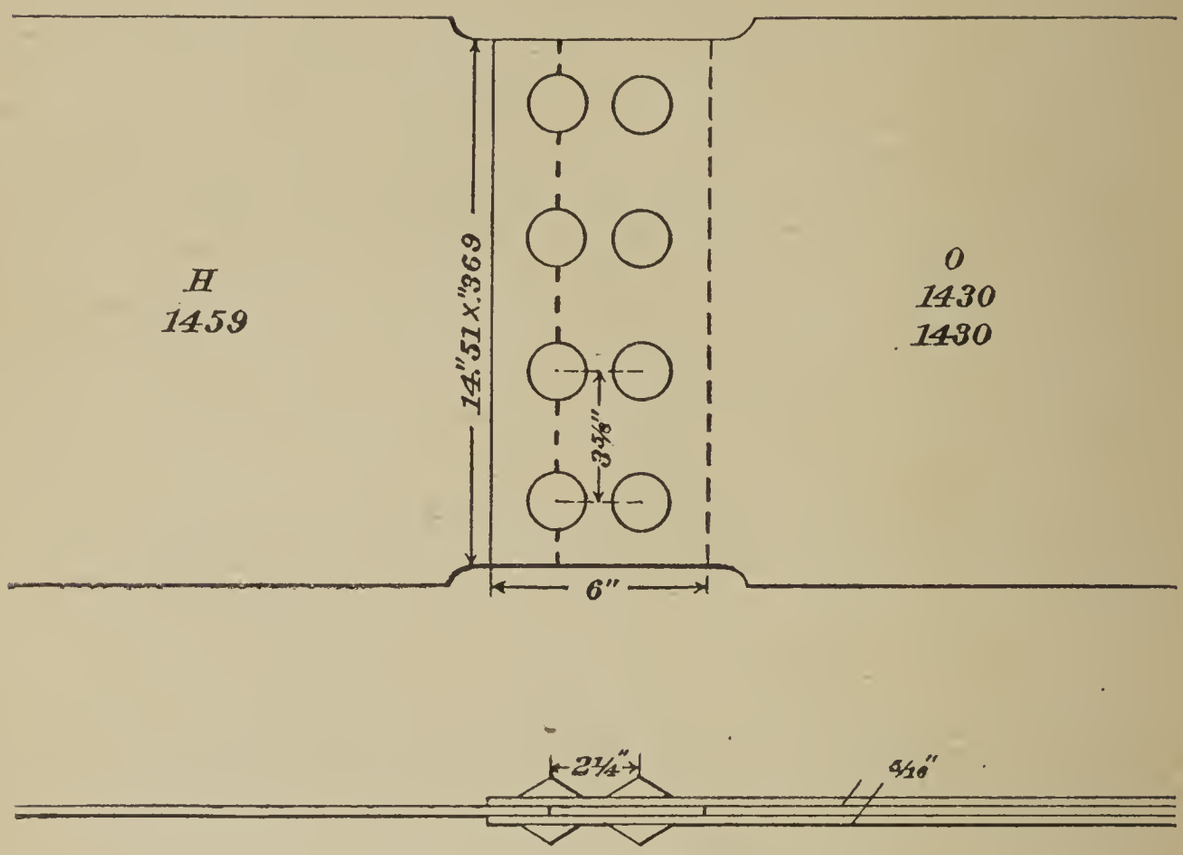
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	43,240
Tension on net section of plate	do	61,200
Compression on bearing surface of rivets	do	73,390
Shearing on rivets	do	17,750

Efficiency of joint, 79.6 per cent.

No. 4957.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ drilled holes; iron rivets, $3\frac{5}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.35
Plate, net sectional area	do	4.25
Plate, bearing surface of rivets	do	2.21
Rivets, shearing area	do	7.07

Tensile strength, 259,500 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, slightly lamellar.

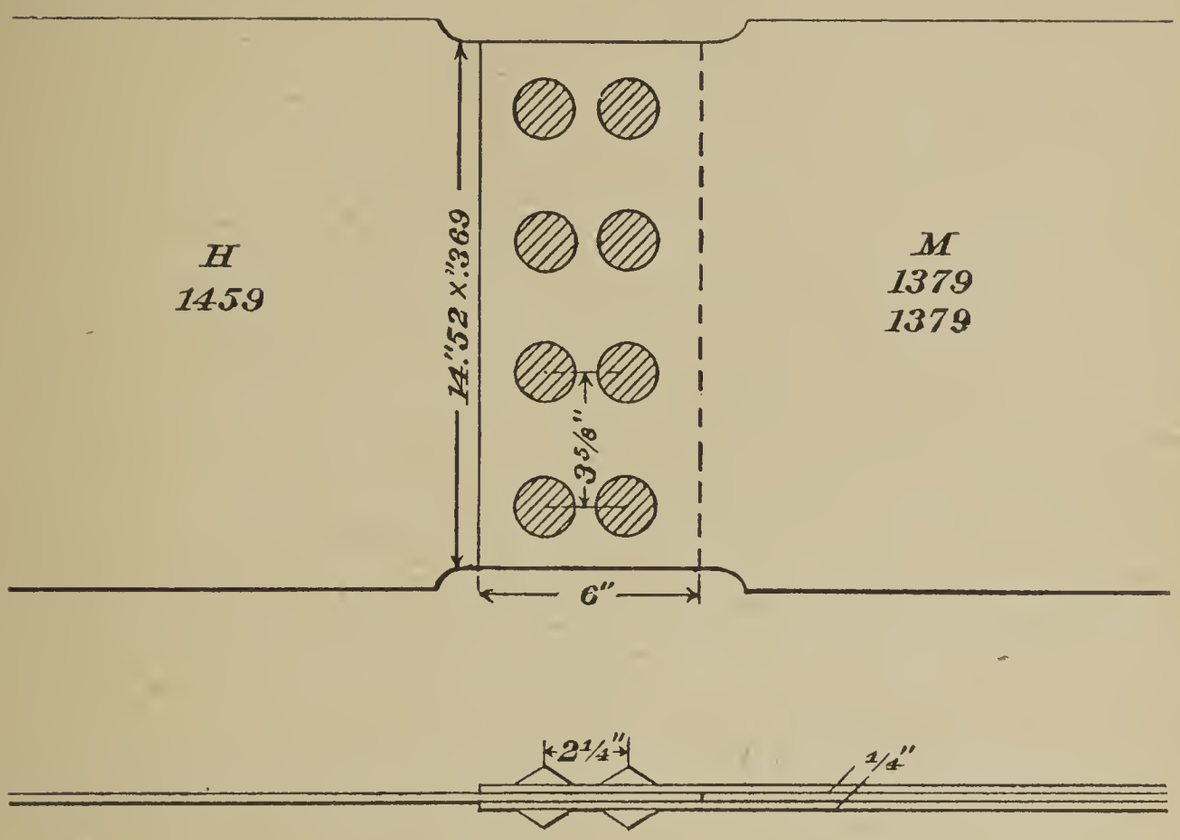
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	48,500
Tension on net section of plate	do	61,060
Compression on bearing surface of rivets	do	117,420
Shearing on rivets	do	36,700

Efficiency of joint, 85.5 per cent.

No. 4958.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ drilled holes; iron rivets, $3\frac{5}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.36
Plate, net sectional area	do	4.25
Plate, bearing surface of rivets	do	2.21
Rivets, shearing area	do	7.07

Tensile strength, 255,690 pounds.

Sheared the rivets.

Elongation of rivet holes: First row, ″.32, ″.39, ″.45, ″.50; second row, ″.12, ″.11, ″.13, ″.12.

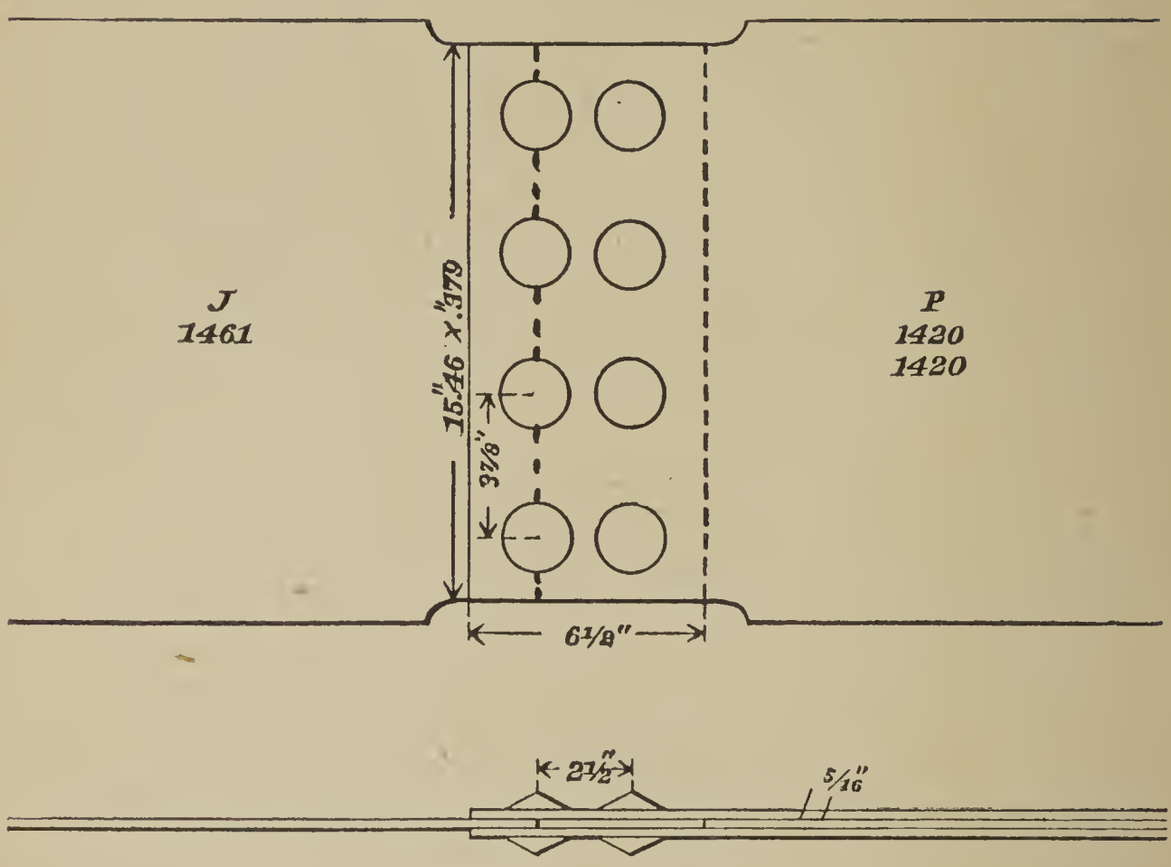
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	47,700
Tension on net section of plate	do	60,160
Compression on bearing surface of rivets	do	115,700
Shearing on rivets	do	36,170

Efficiency of joint, 84.1 per cent.

No. 4971.

($\frac{3}{8}$″ steel plate; 1″ drilled holes; iron rivets, $3\frac{7}{8}$″ pitch."



Areas.

Plate, gross sectional area	square inches	5.86
Plate, net sectional area	do	4.34
Plate, bearing surface of rivets	do	3.03
Rivets, shearing area	do	12.57

Tensile strength, 263,200 pounds.

Fractured plate along first row of rivet holes. Appearance, silky. Average elongation of rivet holes: First row, ″.46*; second row, ″.06.

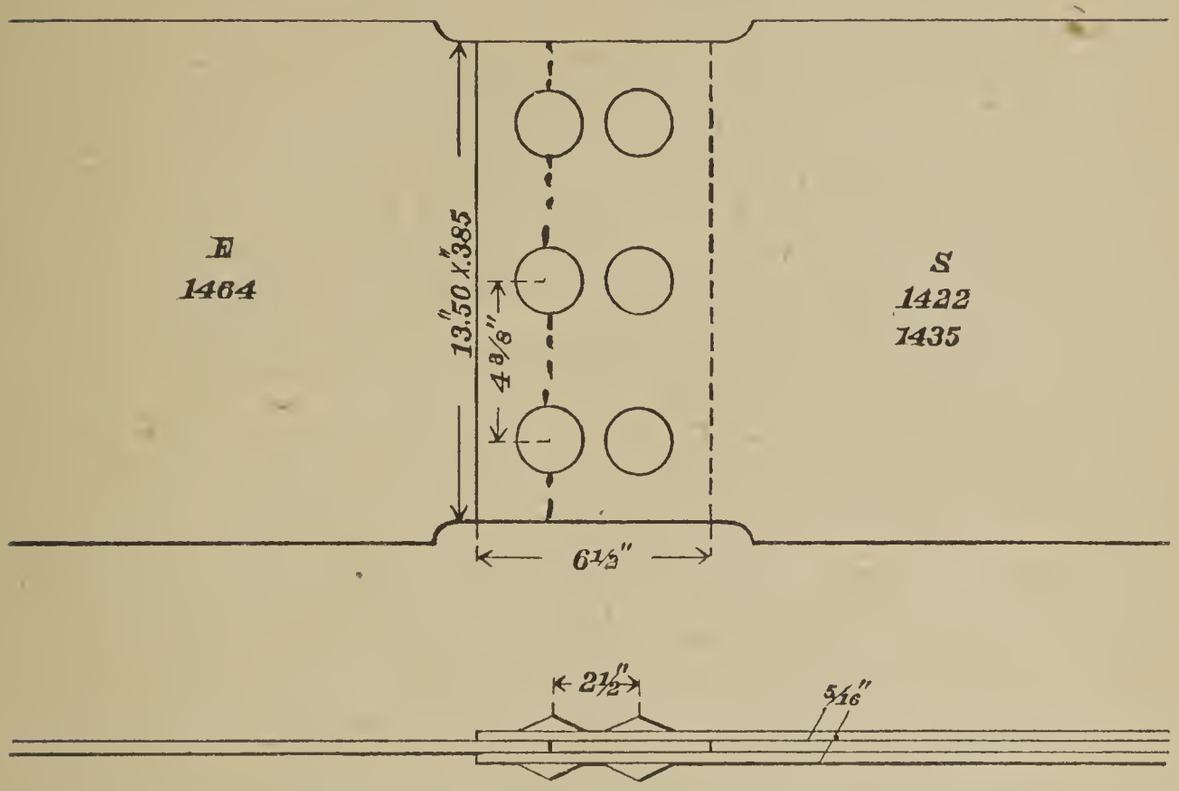
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	44,210
Tension on net section of plate	do	60,650
Compression on bearing surface of rivets	do	86,860
Shearing on rivets	do	20,940

Efficiency of joint, 78.6 per cent.

No. 4973.

($\frac{3}{8}$″ steel plate; 1″ drilled holes; iron rivets, $4\frac{3}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.20
Plate, net sectional area	do	4.04
Plate, bearing surface of rivets	do	2.31
Rivets, shearing area	do	9.42

Tensile strength, 239,100 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, lamellar. Average elongation of rivet holes: First row, ″.38; second row, ″.11.

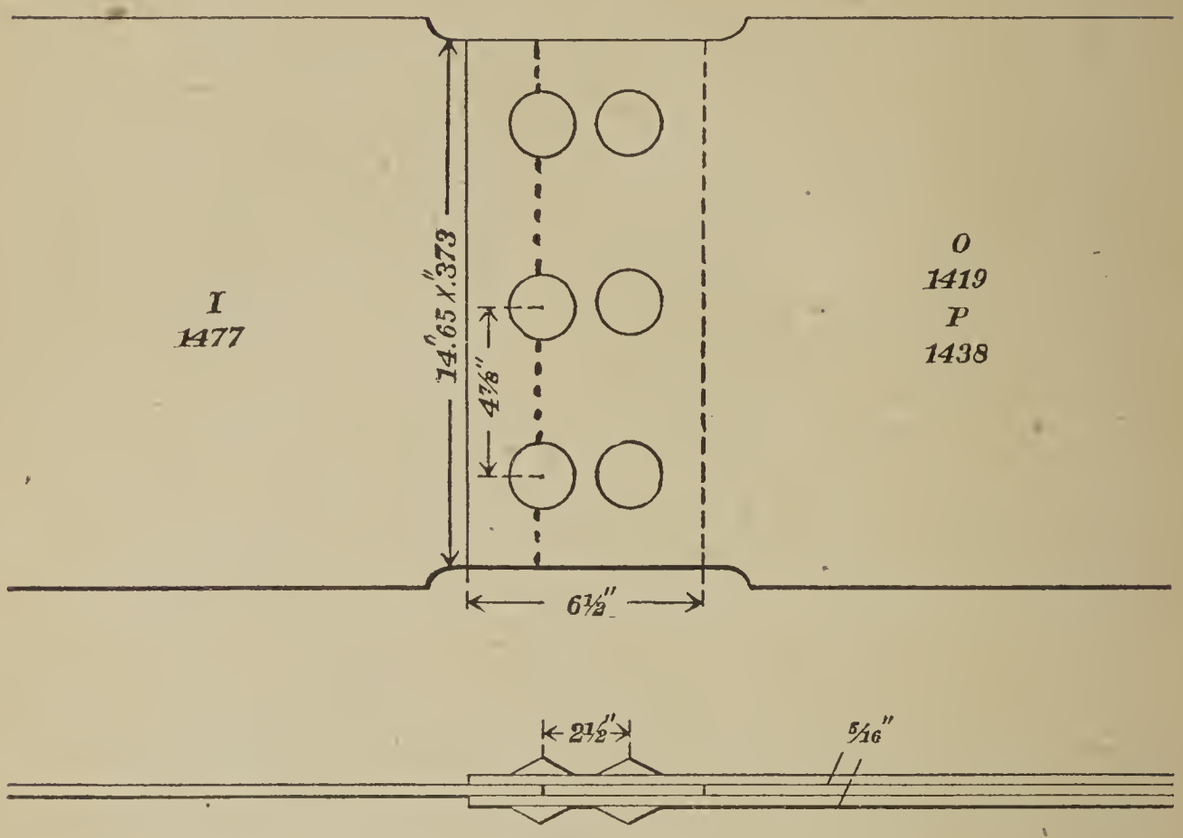
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	45,980
Tension on net section of plate	do	59,180
Compression on bearing surface of rivets	do	103,510
Shearing on rivets	do	25,380

Efficiency of joint, 78.8 per cent.

No. 4975.

($\frac{3}{8}$″ steel plate; 1″ drilled holes; iron rivets, $4\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.46
Plate, net sectional area	do	4.35
Plate, bearing surface of rivets	do	2.24
Rivets, shearing area	do	9.42

Tensile strength, 255,100 pounds.

Fractured plate along first row of rivet holes. Appearance, silky. Average elongation of rivet holes in plate: First row, ″.58; second row, ″.13. No elongation of holes in covers.

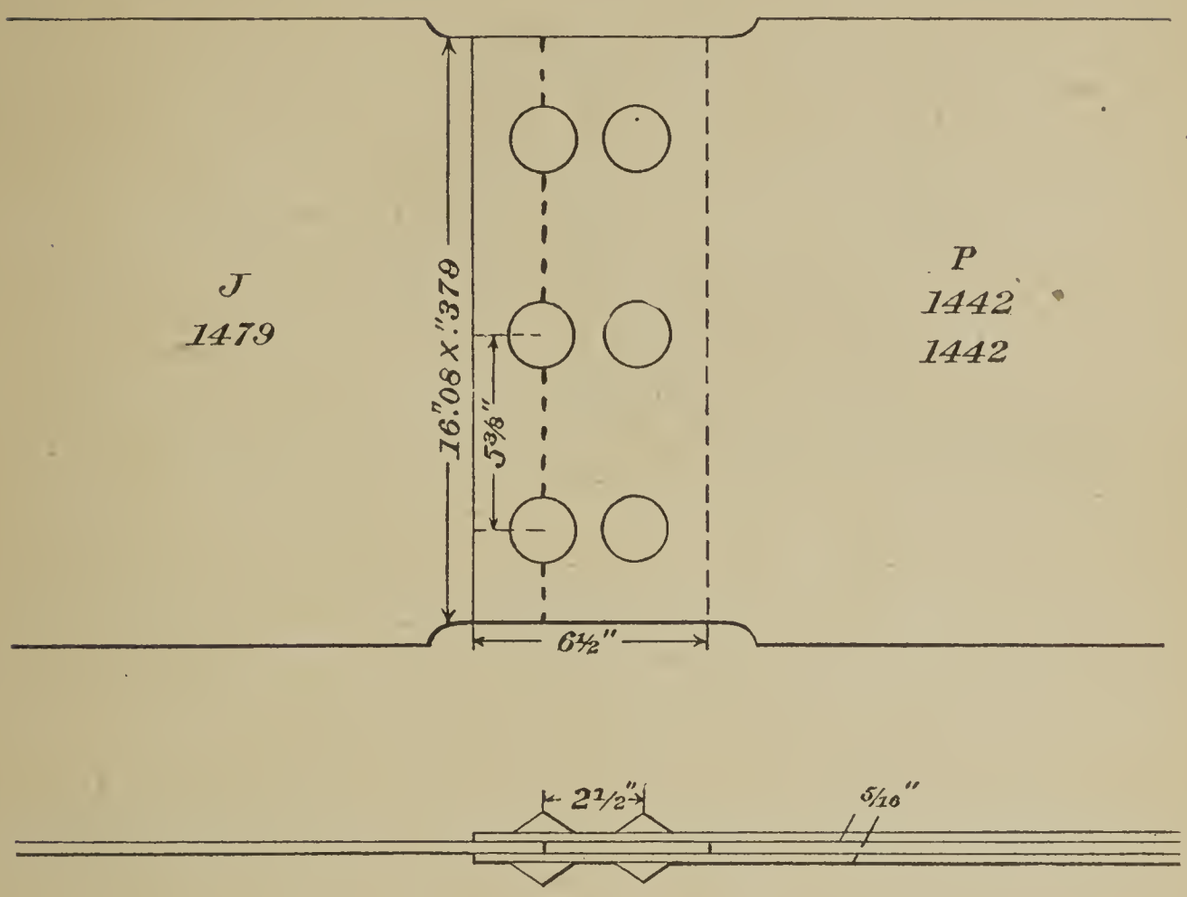
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,720
Tension on net section of plate	do	58,640
Compression on bearing surface of rivets	do	113,880
Shearing on rivets	do	27,080

Efficiency of joint, 79.1 per cent.

No. 4977.

($\frac{3}{8}$″ steel plate; 1″ drilled holes; iron rivets, $5\frac{3}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	6.09
Plate, net sectional area	do	4.96
Plate, bearing surface of rivets	do	2.27
Rivets, shearing area	do	9.42

Tensile strength, 271,940 pounds.

Fractured plate along first row of rivet holes. Appearance, silky. Average elongation of rivet holes in plate: First row, ″.60; second row, ″.19. No elongation of rivet holes in covers.

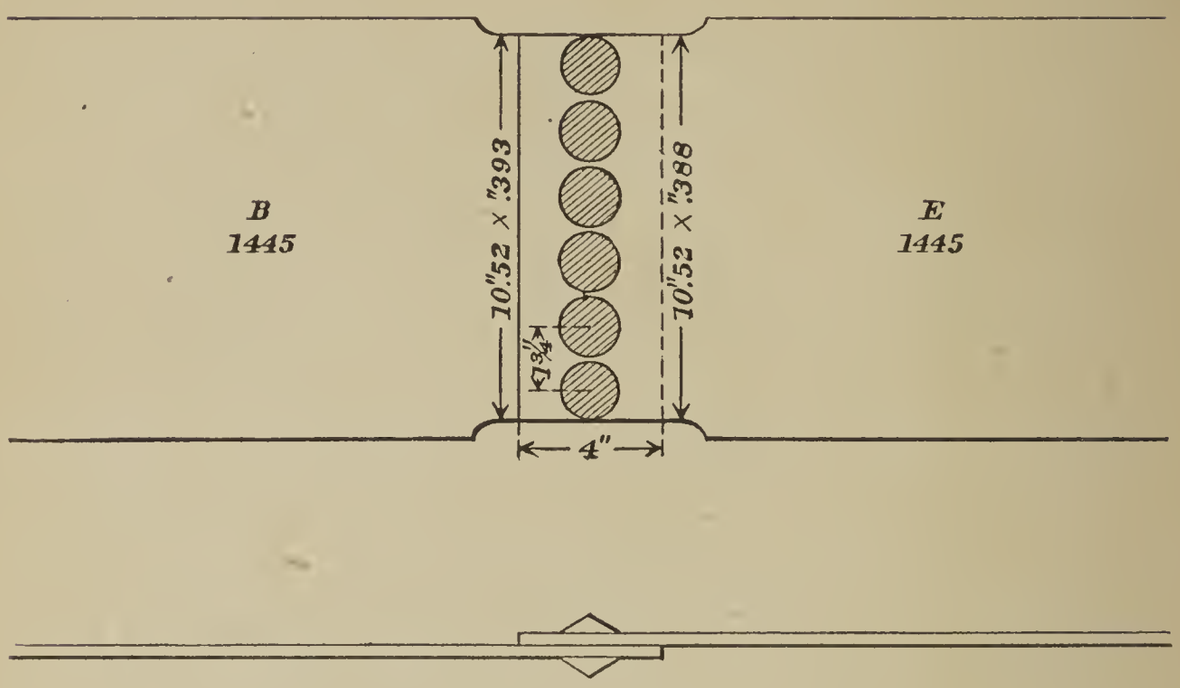
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	44,650
Tension on net section of plate	do	54,830
Compression on bearing surface of rivets	do	119,800
Shearing on rivets	do	28,870

Efficiency of joint, 78.1 per cent.

No. 4961.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ drilled holes; iron rivets, $1\frac{3}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.08
Plate, net sectional area	do	2.33
Plate, bearing surface of rivets	do	1.75
Rivets, shearing area	do	2.65

Tensile strength, 105,880 pounds.
Sheared the rivets.
Elongation of rivet holes, ″.05 each.

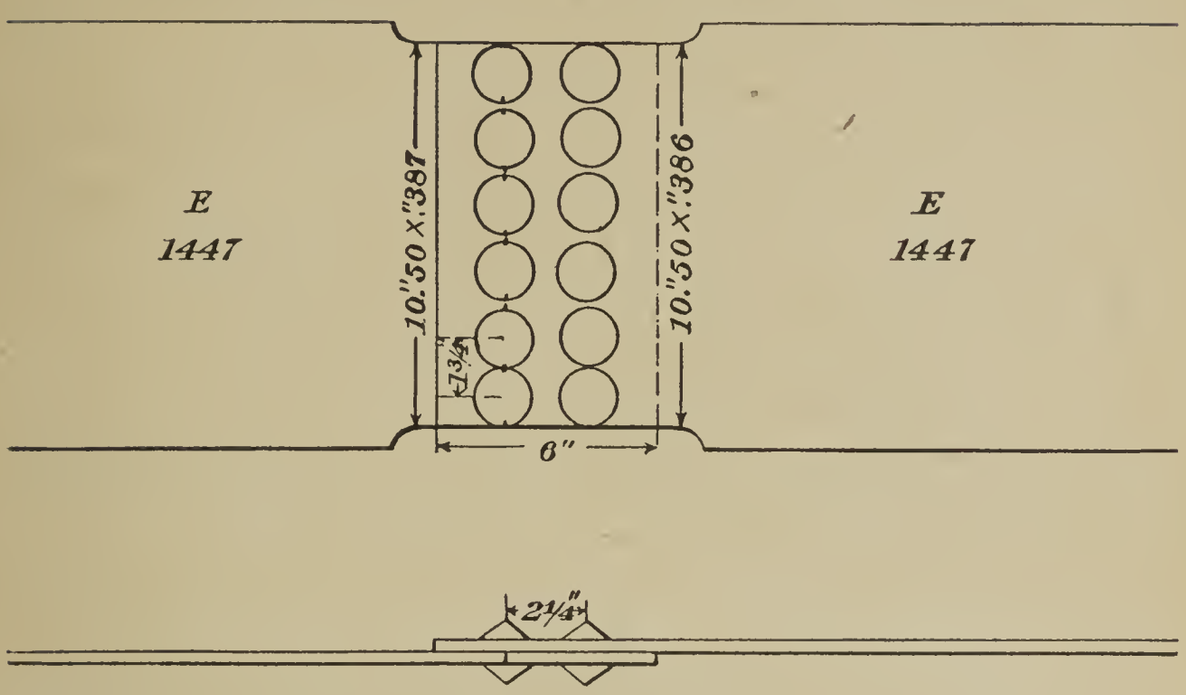
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	25,950
Tension on net section of plate	do	45,440
Compression on bearing surface of rivets	do	60,500
Shearing on rivets	do	39,950

Efficiency of joint, 44.4 per cent.

No. 4963.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ drilled holes; iron rivets, $1\frac{3}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.06
Plate, net sectional area	do	2.32
Plate, bearing surface of rivets	do	3.48
Rivets, shearing area	do	5.30

Tensile strength, 164,700 pounds.

Fractured plate across first row of rivet holes. Appearance, silky, lamellar.

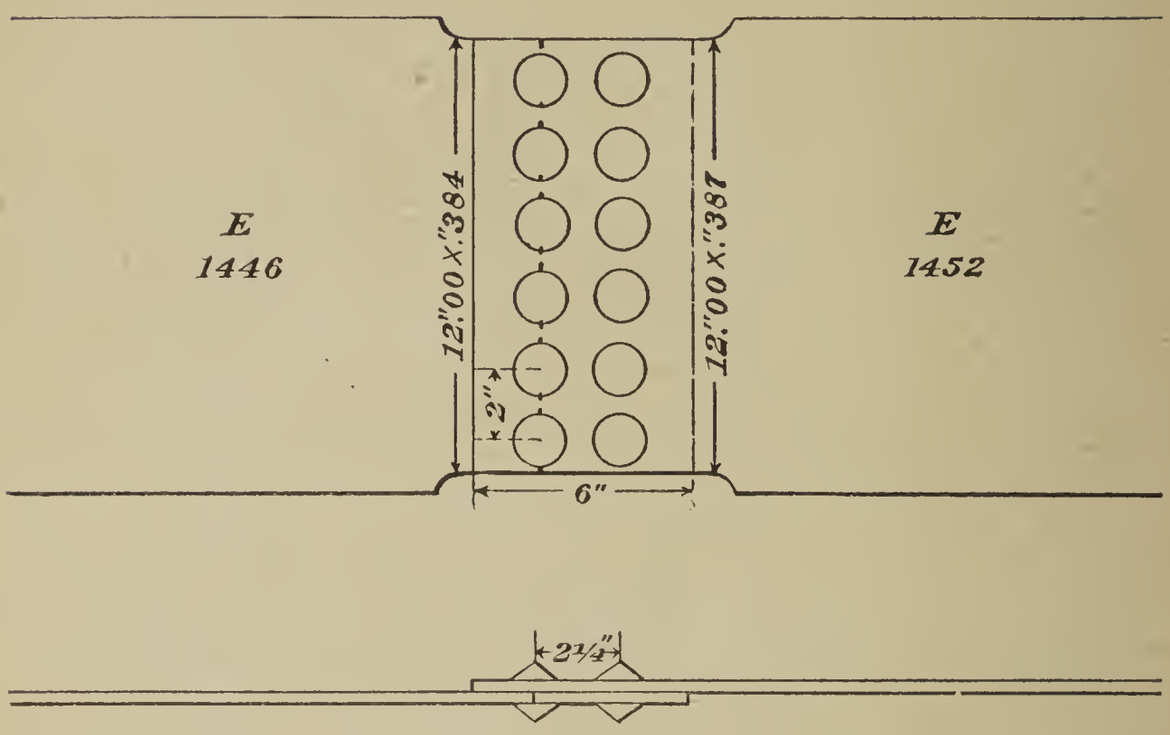
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	40,570
Tension on net section of plate	do	70,990
Compression on bearing surface of rivets	do	47,330
Shearing on rivets	do	31,080

Efficiency of joint, 69.5 per cent.

No. 4965.

($\frac{3}{8}$″ steel plate; $\frac{3}{4}$″ drilled holes; iron rivets, 2″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.61
Plate, net sectional area	do	2.88
Plate, bearing surface of rivets	do	3.46
Rivets, shearing area	do	5.30

Tensile strength, 194,300 pounds.

Fractured plate along line of rivet holes. Appearance, silky.

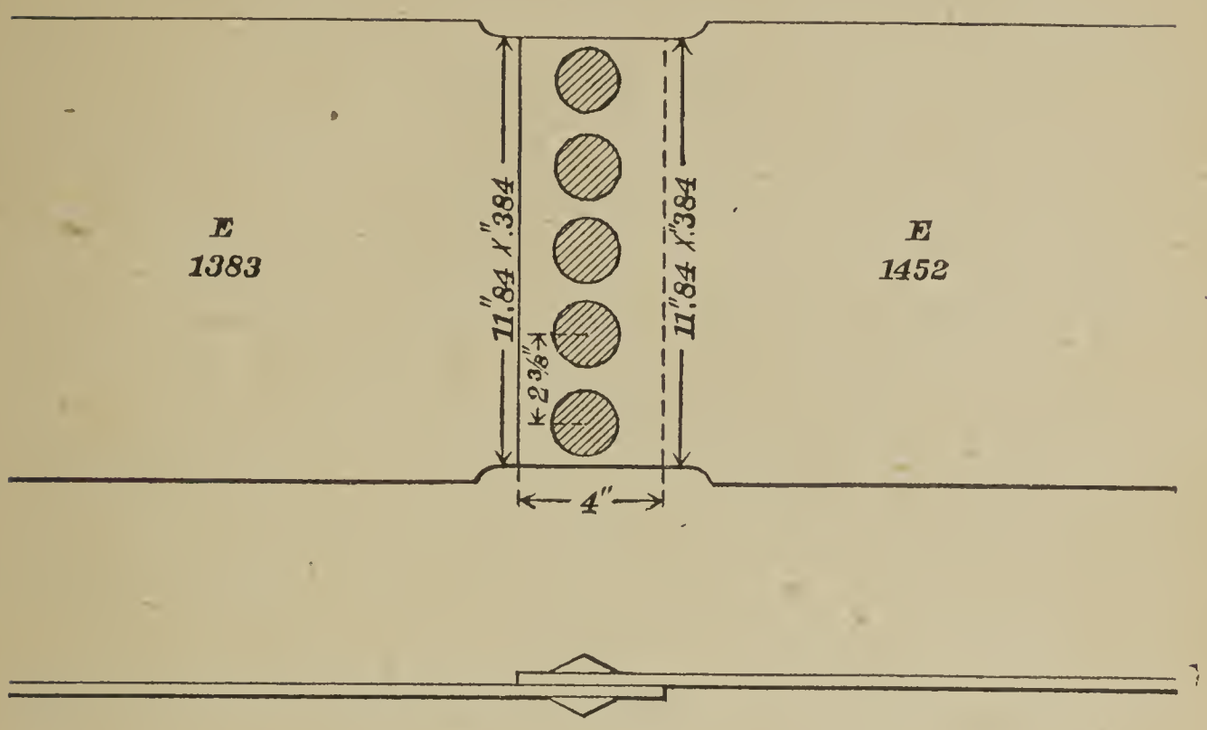
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,150
Tension on net section of plate	do	67,470
Compression on bearing surface of rivets	do	56,160
Shearing on rivets	do	36,660

Efficiency of joint, 72.2 per cent.

No. 4979.

($\frac{3}{8}$″ steel plate; 1″ drilled holes; iron rivets, $2\frac{3}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.55
Plate, net sectional area	do	2.63
Plate, bearing surface of rivets	do	1.92
Rivets, shearing area	do	3.93

Tensile strength, 150,400 pounds.
Sheared the rivets.
Average elongation of rivet holes, ″.06 each.

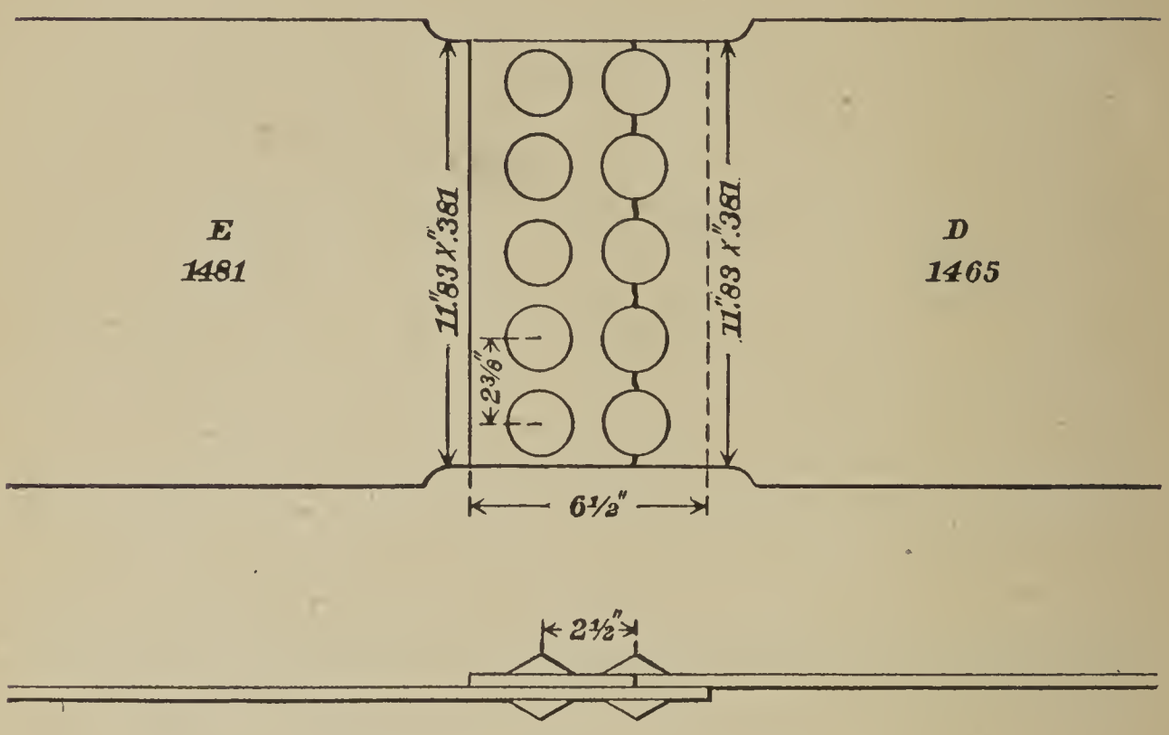
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	33,050
Tension on net section of plate	do	57,190
Compression on bearing surface of rivets	do	78,330
Shearing on rivets	do	38,270

Efficiency of joint, 56.6 per cent.

No. 4981.

($\frac{3}{8}$″ steel plate; 1″ drilled holes; iron rivets, $2\frac{3}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	4.55
Plate, net sectional area	do	2.63
Plate, bearing surface of rivets	do	3.85
Rivets, shearing area	do	7.85

Tensile strength, 176,480 pounds.

Fractured plate D along line of rivet holes. Appearance, silky, lamellar.

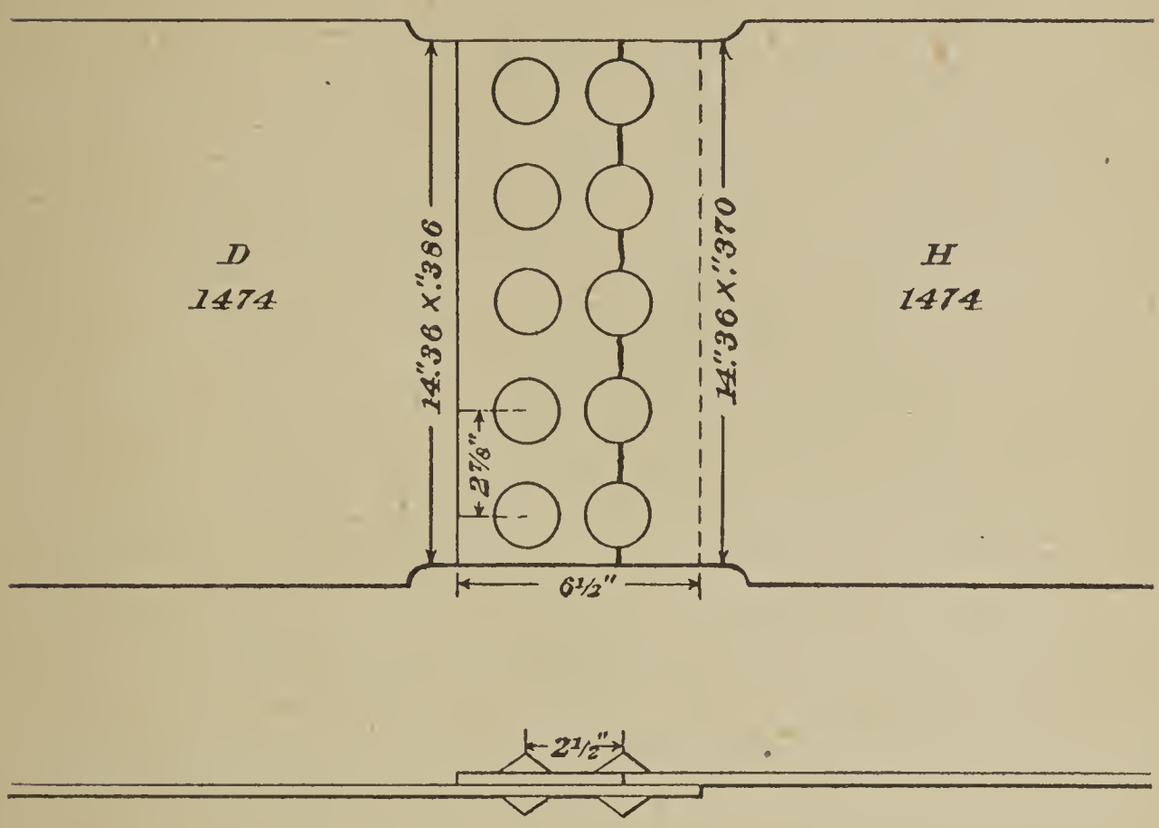
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	38,790
Tension on net section of plate	do	67,100
Compression on bearing surface of rivets	do	45,840
Shearing on rivets	do	22,480

Efficiency of joint, 72.2 per cent.

No. 4983.

($\frac{3}{8}$″ steel plate; 1″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.31
Plate, net sectional area	do	3.46
Plate, bearing surface of rivets	do	3.70
Rivets, shearing area	do	7.85

Tensile strength, 228,600 pounds.

Fractured plate H 1474 along first row of rivet holes. Appearance, silky, slightly lamellar. Average elongation of rivet holes: Plate H 1474, first row, ″.47*; second row, ″.00. Plate D 1474, first row, ″.22; second row, ″.00.

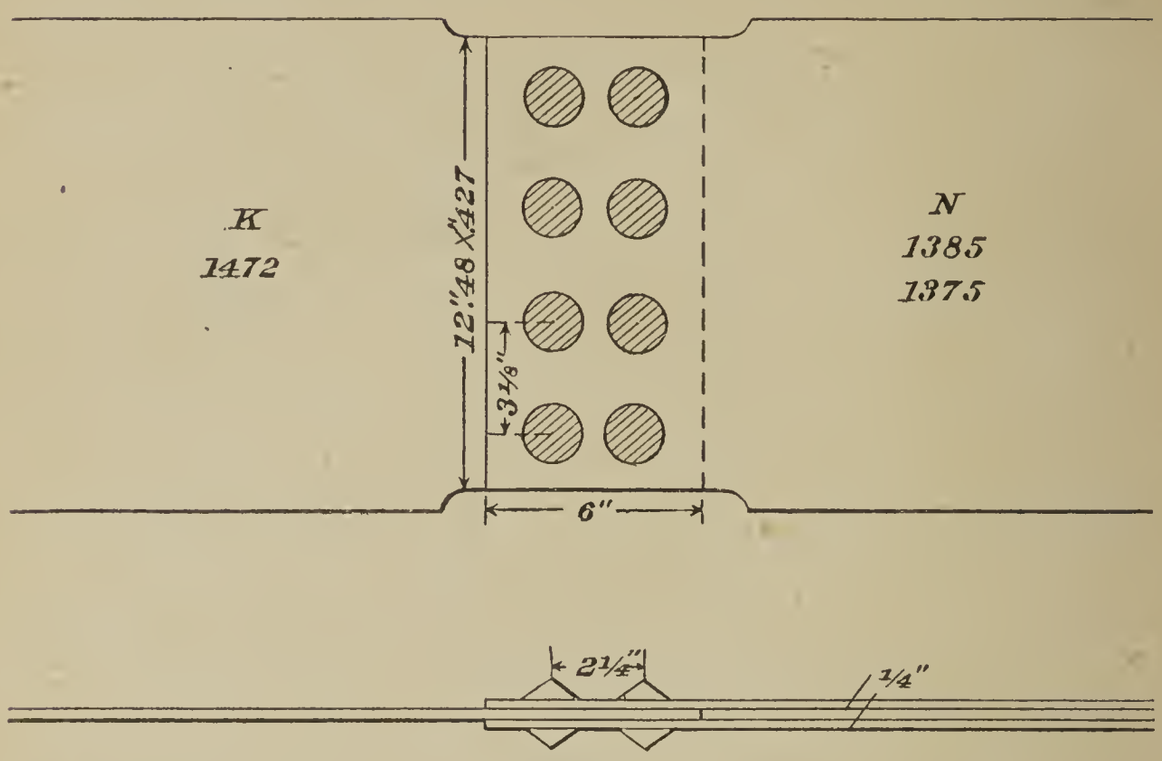
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	43,050
Tension on net section of plate	do	66,070
Compression on bearing surface of rivets	do	61,780
Shearing on rivets	do	29,120

Efficiency of joint, 76 per cent.

No. 4956.

($\frac{7}{16}$″ steel plate; $\frac{3}{4}$″ drilled holes; iron rivets, $3\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches..	5.33
Plate, net sectional area	do....	4.05
Plate, bearing surface of rivets	do....	2.56
Rivets, shearing area	do....	7.07

Tensile strength, 256,500 pounds.

Sheared the rivets.

Elongation of rivet holes in plate: ~~First~~ Sec row, ".27, ".23, ".27, ".32; first ~~second~~ row, ".80 each.

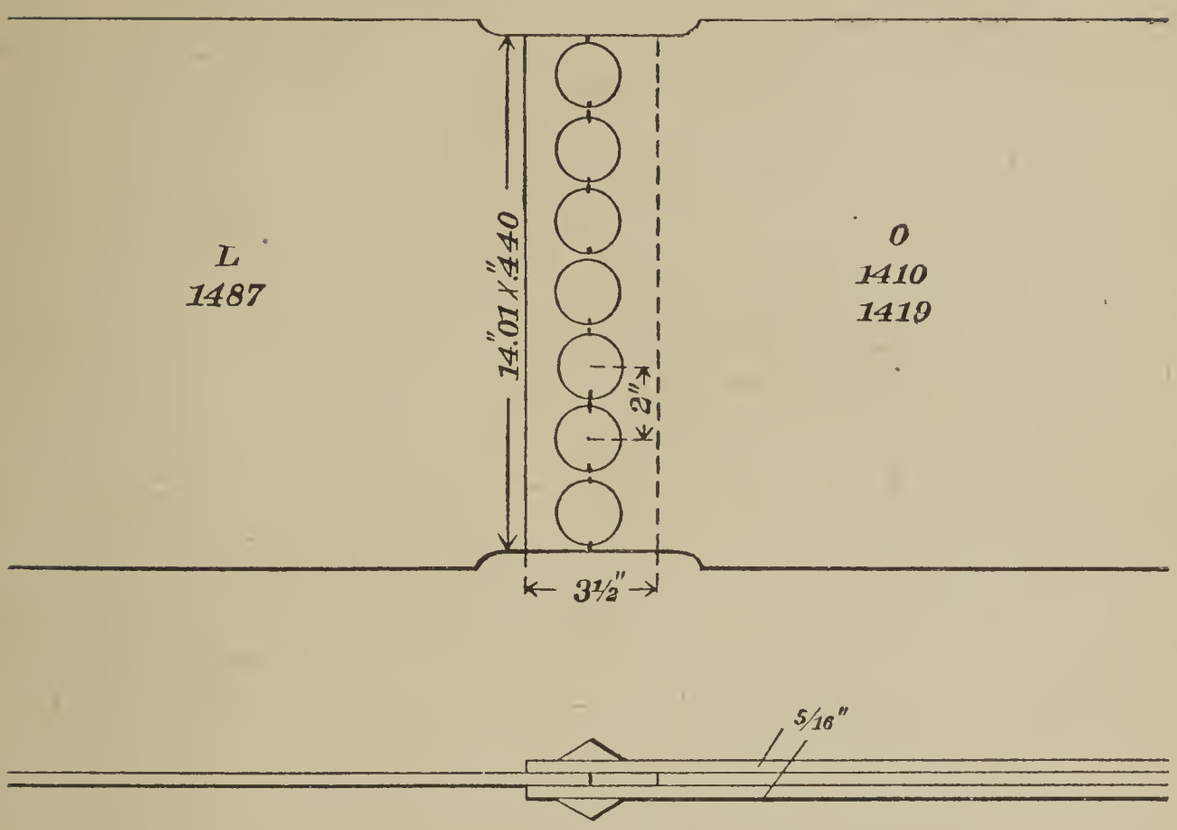
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	48,120
Tension on net section of plate	do....	63,300
Compression on bearing surface of rivets	do....	100.190
Shearing on rivets	do....	36,280

Efficiency of joint, 83.3 per cent.

No. 5144.

($\frac{7}{16}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, 2″ pitch.)



Areas.

Plate, gross sectional area	square inches	6.16
Plate, net sectional area	do	3.48
Plate, bearing surface of rivets	do	2.69
Rivets, shearing area	do	8.41

Tensile strength, 143,900 pounds.
Fractured plate along line of rivet holes. Appearance, silky.

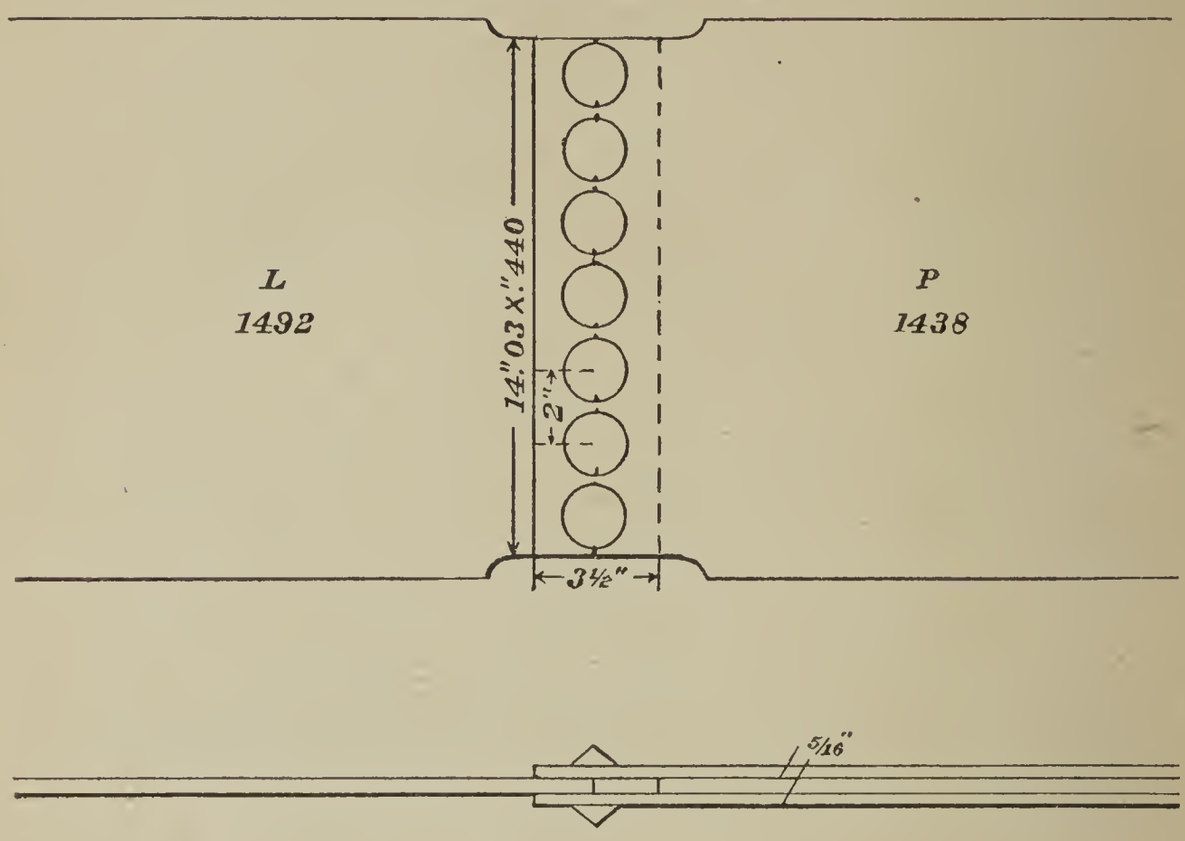
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	23,360
Tension on net section of plate	do	41,350
Compression on bearing surface of rivets	do	53,490
Shearing on rivets	do	17,110

Efficiency of joint, 39.3 per cent.

No. 5143.

($\frac{7}{16}$″ steel plate; punched holes, punch, $\frac{7}{8}$″; die, $\frac{15}{16}$″; iron rivets, 2″ pitch.)



Areas.

Plate, gross sectional area	square inches	6.17
Plate, net sectional area	do	3.38
Plate, bearing surface of rivets	do	2.79
Rivets, shearing area	do	8.41

Tensile strength, 200,800 pounds.

Fractured plate along line of rivet holes. Appearance, granular excepting one section, which was silky.

Average elongation of rivet holes in plate, ″.30. No elongation of holes in covers.

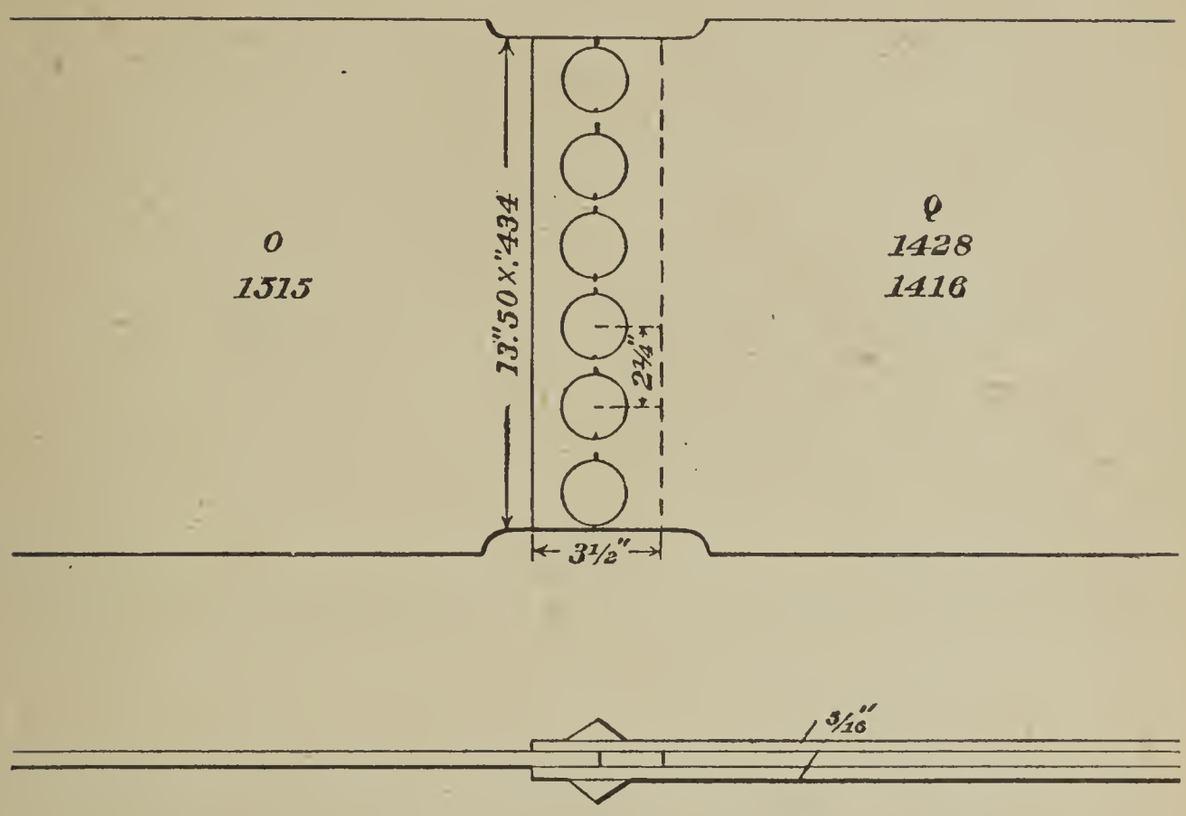
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	32,540
Tension on net section of plate	do	59,410
Compression on bearing surface of rivets	do	71,970
Shearing on rivets	do	23,880

Efficiency of joint, 54.8 per cent.

No. 5145.

($\frac{7}{16}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{1}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.86
Plate, net sectional area	do	3.58
Plate, bearing surface of rivets	do	2.28
Rivets, shearing area	do	7.21

Tensile strength, 247,600 pounds.
Fractured plate along line of rivet holes. Appearance, silky.

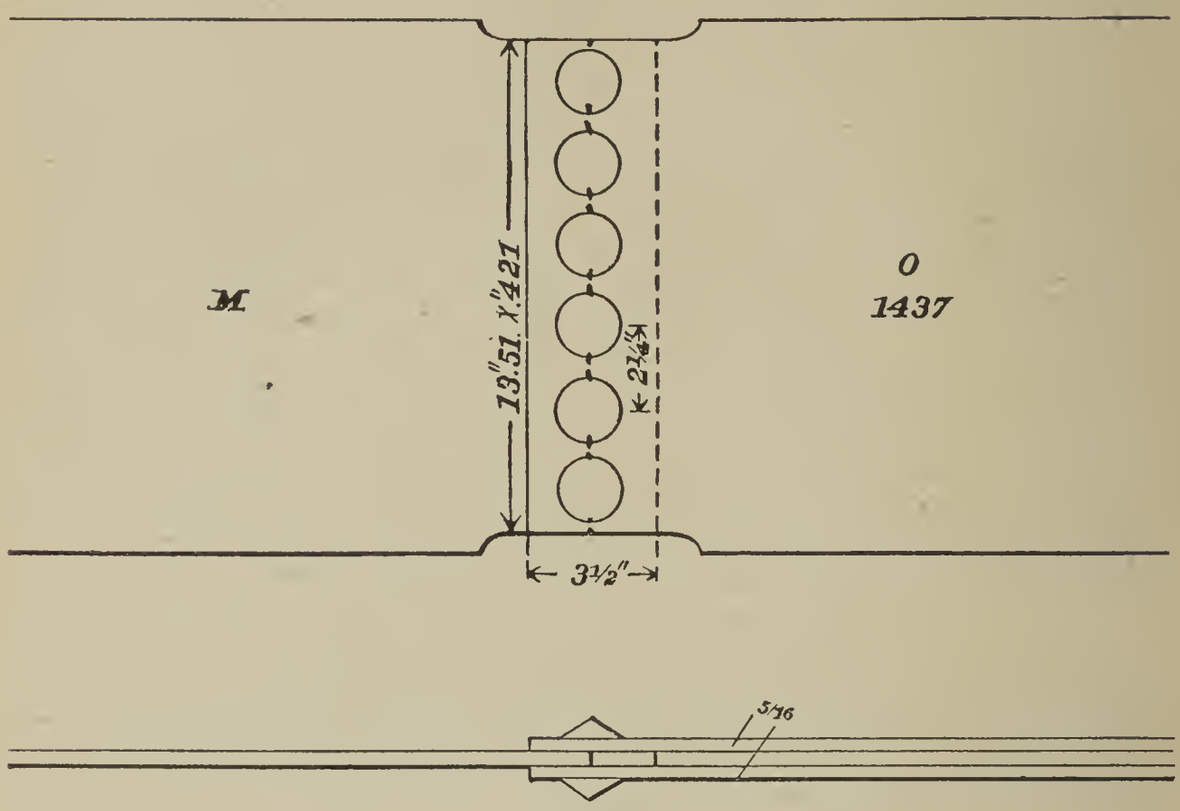
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,250
Tension on net section of plate	do	69,160
Compression on bearing surface of rivets	do	108,600
Shearing on rivets	do	34,340

Efficiency of joint, 79.8 per cent.

No. 5146.

($\frac{7}{16}$″ steel plate; punched holes, punch, $\frac{7}{8}$″; die, $\frac{15}{16}$″; iron rivets, $2\frac{1}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.69
Plate, net sectional area	do	3.40
Plate, bearing surface of rivets	do	2.29
Rivets, shearing area	do	7.21

Tensile strength, 226,100 pounds.
Fractured plate along line of rivet holes. Appearance, silky.

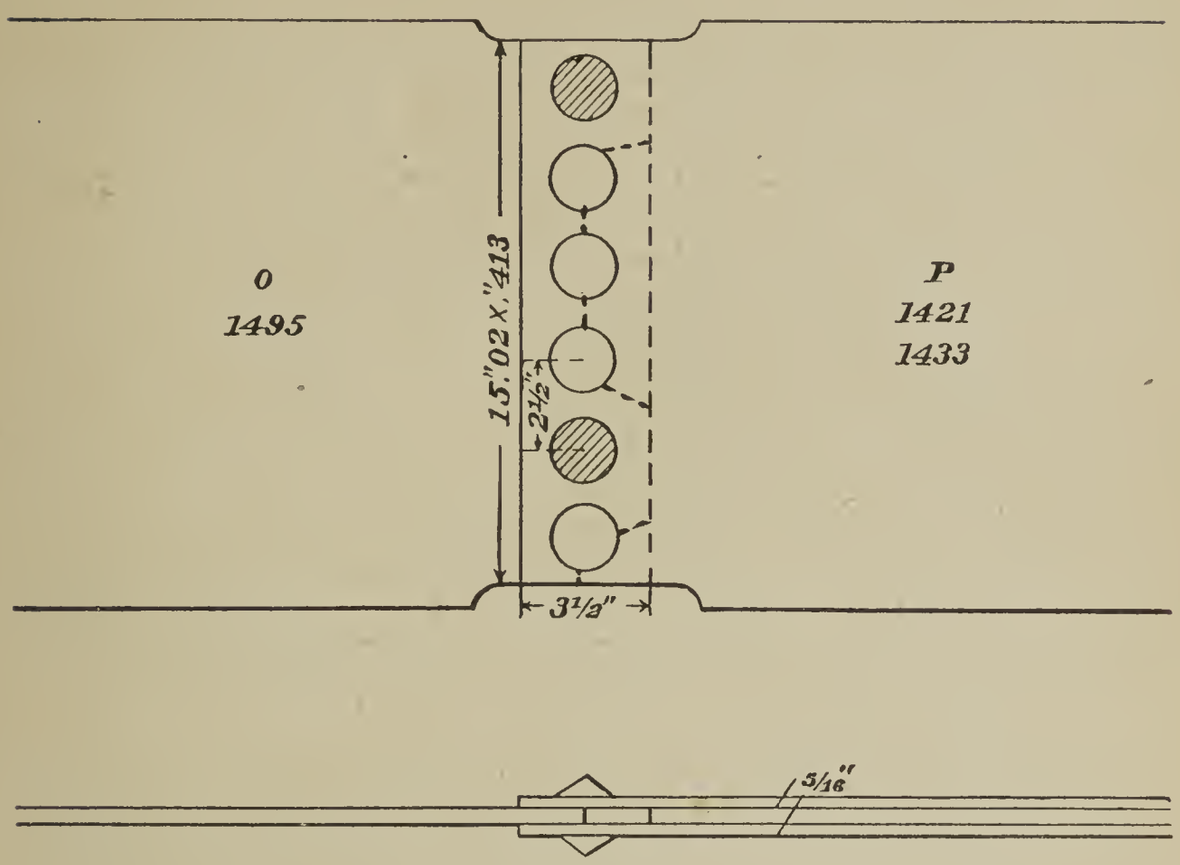
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	39,740
Tension on net section of plate	do	66,500
Compression on bearing surface of rivets	do	98,730
Shearing on rivets	do	31,360

Efficiency of joint, 64.5 per cent.

No. 5147.

($\frac{7}{16}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	6.20
Plate, net sectional area	do	4.03
Plate, bearing surface of rivets	do	2.17
Rivets, shearing area	do	7.21

Tensile strength, 273,700 pounds.

Sheared two rivets, fractured two sections between rivet holes, and tore out plate. Appearance, silky.

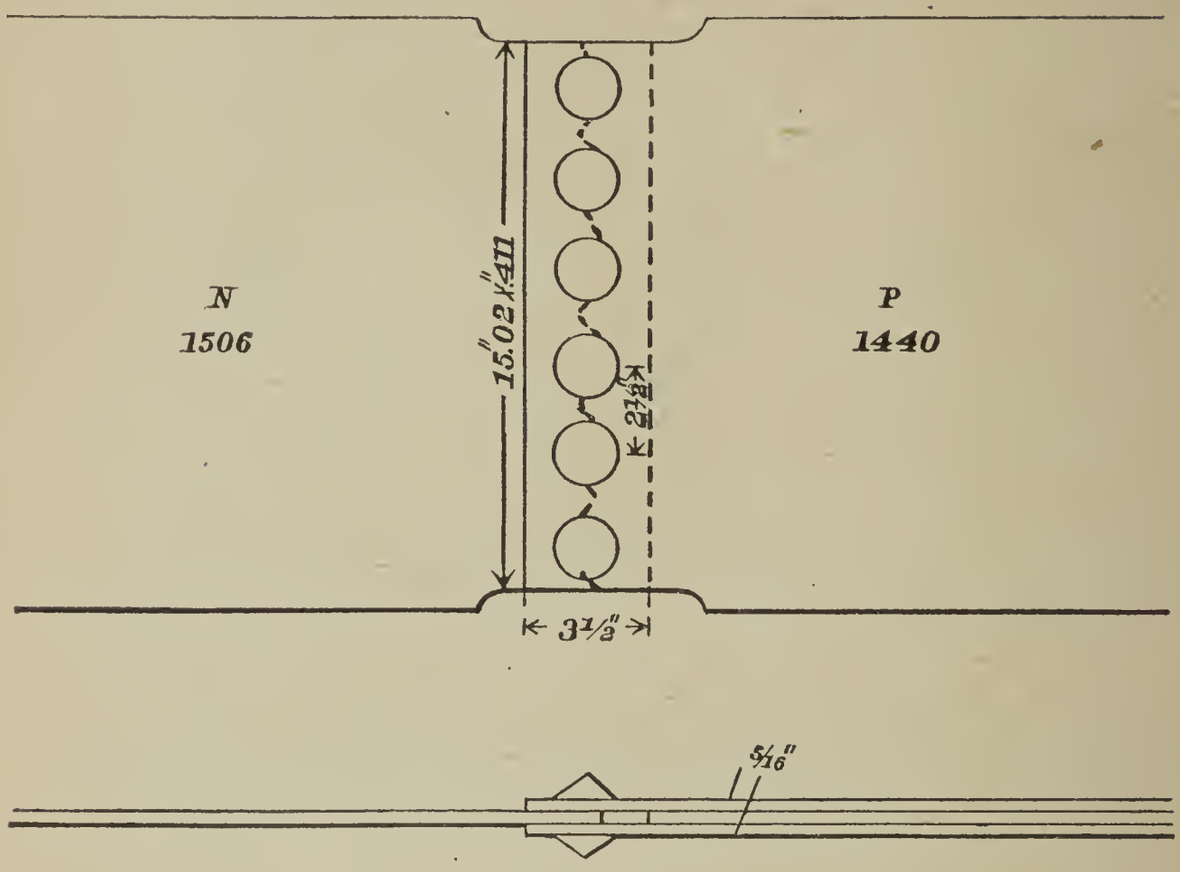
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	44,150
Tension on net section of plate	do	67,920
Compression on bearing surface of rivets	do	126,130
Shearing on rivets	do	37,960

Efficiency of joint, 83.4 per cent.

No. 5148.

($\frac{7}{16}$'' steel plate; punched holes; punch, $\frac{7}{8}$''; die, $\frac{15}{16}$''; iron rivets, $2\frac{1}{2}$'' pitch.)



Areas.

Plate, gross sectional area	square inches	6.17
Plate, net sectional area	do	3.94
Plate, bearing surface of rivets	do	2.23
Rivets, shearing area	do	7.21

Tensile strength, 226,200 pounds.

Fractured plate along line of rivet holes, taking an irregular course. Appearance, silky, excepting a small granular spot alongside one rivet hole.

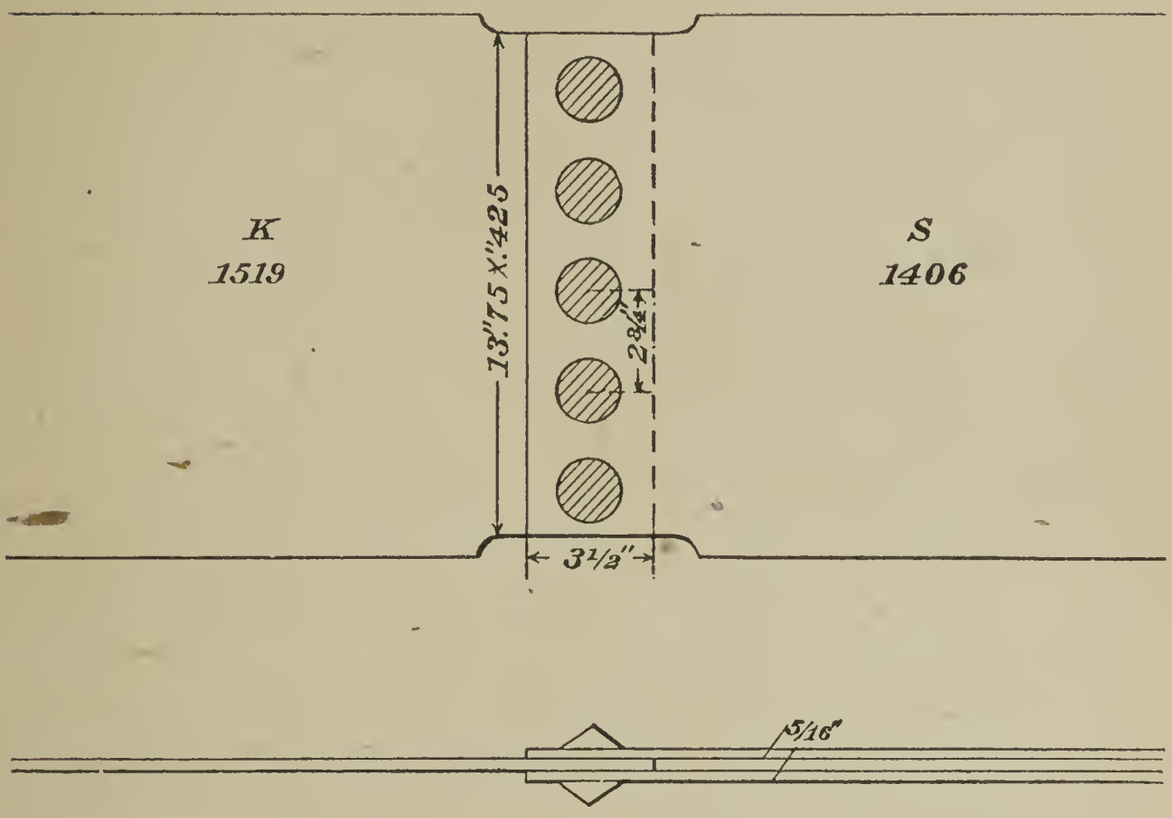
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	36,660
Tension on net section of plate	do	57,410
Compression on bearing surface of rivets	do	101,430
Shearing on rivets	do	31,370

Efficiency of joint, 60 per cent.

No. 5155.

($\frac{7}{16}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{3}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.84
Plate, net sectional area	do	3.98
Plate, bearing surface of rivets	do	1.86
Rivets, shearing area	do	6.01

Tensile strength, 235,200 pounds.
Sheared the rivets.
Elongation of rivet holes: ″.25, ″.25, ″.35, ″.35, ″.30.

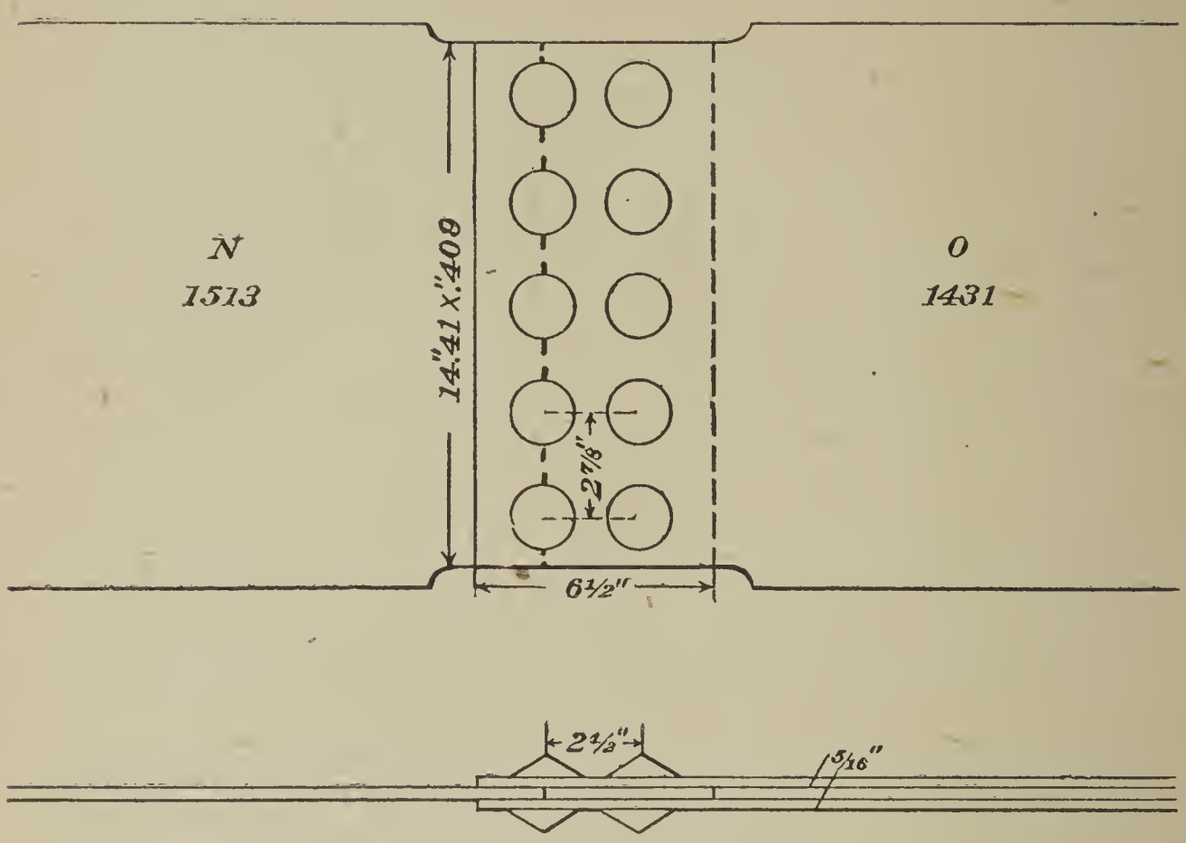
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	40,270
Tension on net section of plate	do	59,100
Compression on bearing surface of rivets	do	126,450
Shearing on rivets	do	39,130

Efficiency of joint, 68.3 per cent.

No. 4968.

($\frac{7}{16}$″ steel plate; 1″ drilled holes; iron rivets, $2\frac{7}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.89
Plate, net sectional area	do	3.85
Plate, bearing surface of rivets	do	4.09
Rivets, shearing area	do	15.71

Tensile strength, 255,400 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, slightly lamellar. Average elongation of rivet holes in plate: First row, ″.48*; second row, ″.00. No elongation of holes in covers.

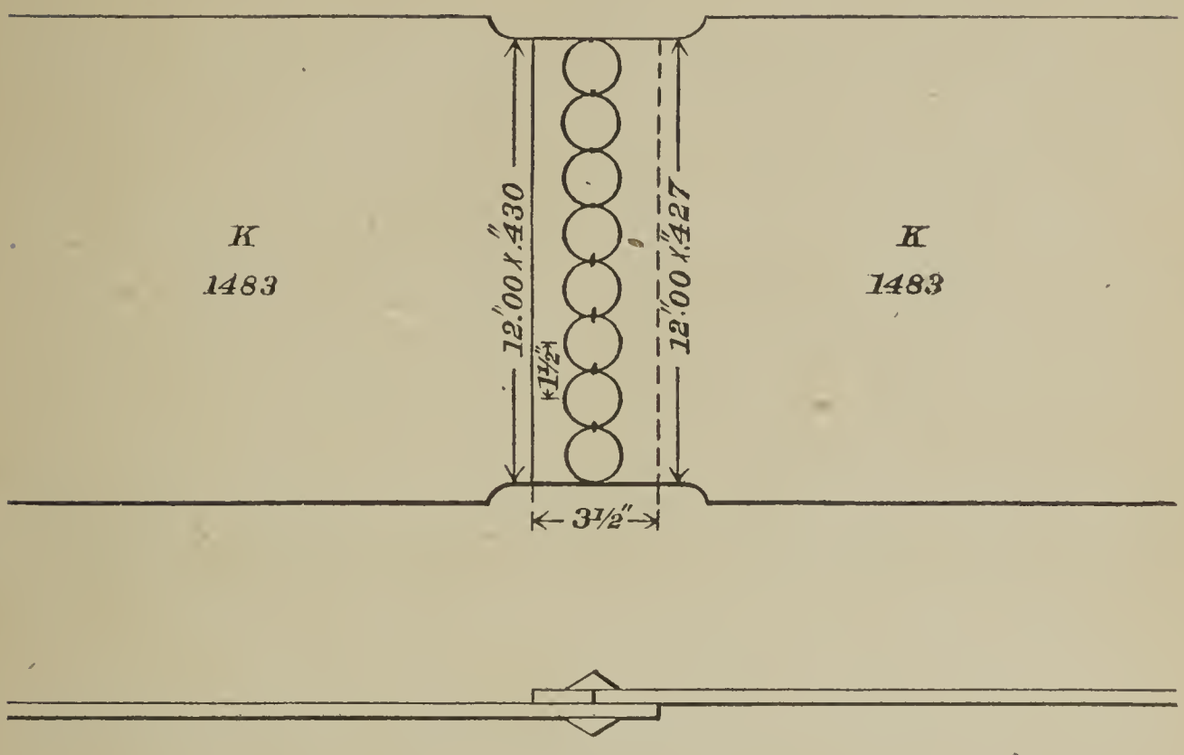
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	43,360
Tension on net section of plate	do	66,340
Compression on bearing surface of rivets	do	62,440
Shearing on rivets	do	16,260

Efficiency of joint, 70.9 per cent.

No. 5131.

($\frac{7}{16}$″ steel plate; $\frac{7}{8}$″ drilled holes; iron rivets, $1\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.12
Plate, net sectional area	do	2.13
Plate, bearing surface of rivets	do	2.99
Rivets, shearing area	do	4.81

Tensile strength, 162,500 pounds.
Fractured plate along line of rivet holes. Appearance, silky, lamellar.

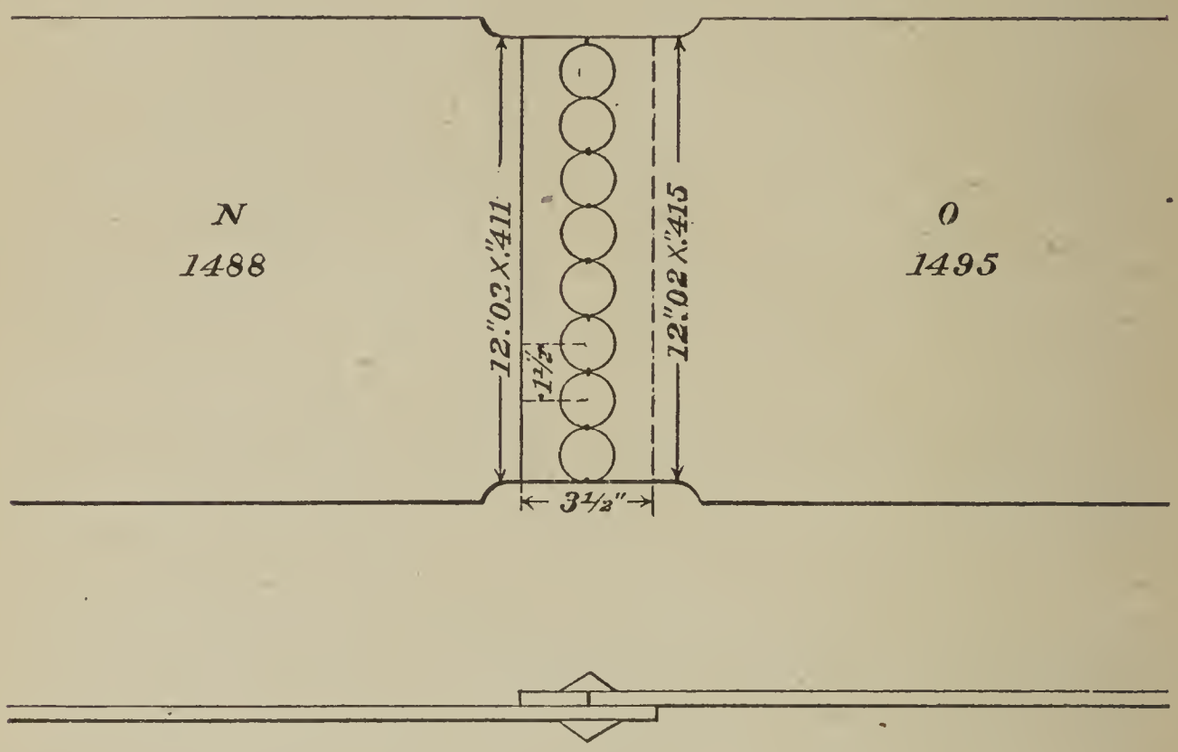
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	31,740
Tension on net section of plate	do	76,290
Compression on bearing surface of rivets	do	54,350
Shearing on rivets	do	33,780

Efficiency of joint, 53.8 per cent.

No. 5132.

($\frac{7}{16}$″ steel plates; punched holes, punch, $\frac{7}{8}$″; die, $\frac{15}{16}$″; iron rivets, 1½″ pitch.



Areas.

Plate, gross sectional area	square inches	4.99
Plate, net sectional area	do	1.98
Plate, bearing surface of rivets	do	3.01
Rivets, shearing area	do	4.81

Tensile strength, 138,800 pounds.

Fractured plate O 1495 along line of rivet holes. Appearance, granular, excepting one end of section, which was silky.

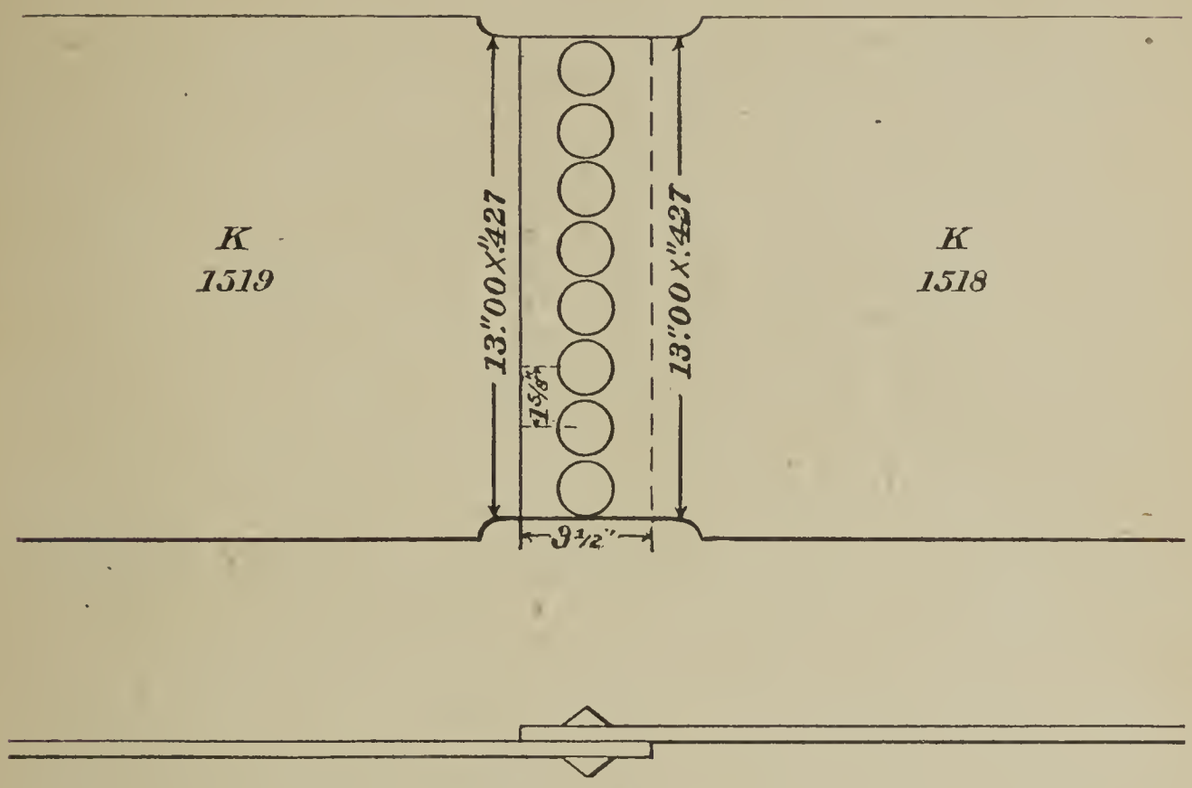
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	27,820
Tension on net section of plate	do	70,100
Compression on bearing surface of rivets	do	46,110
Shearing on rivets	do	28,860

Efficiency of joint, 52.6 per cent.

No. 5133.

($\frac{7}{16}$″ steel plates; $\frac{7}{8}$″ drilled holes; iron rivets, $1\frac{5}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.55
Plate, net sectional area	do	2.56
Plate, bearing surface of rivets	do	2.99
Rivets, shearing area	do	4.81

Tensile strength, 172,600 pounds.

Pulled the heads off rivets. Plates not fractured. Average elongation of rivet holes ″.10.

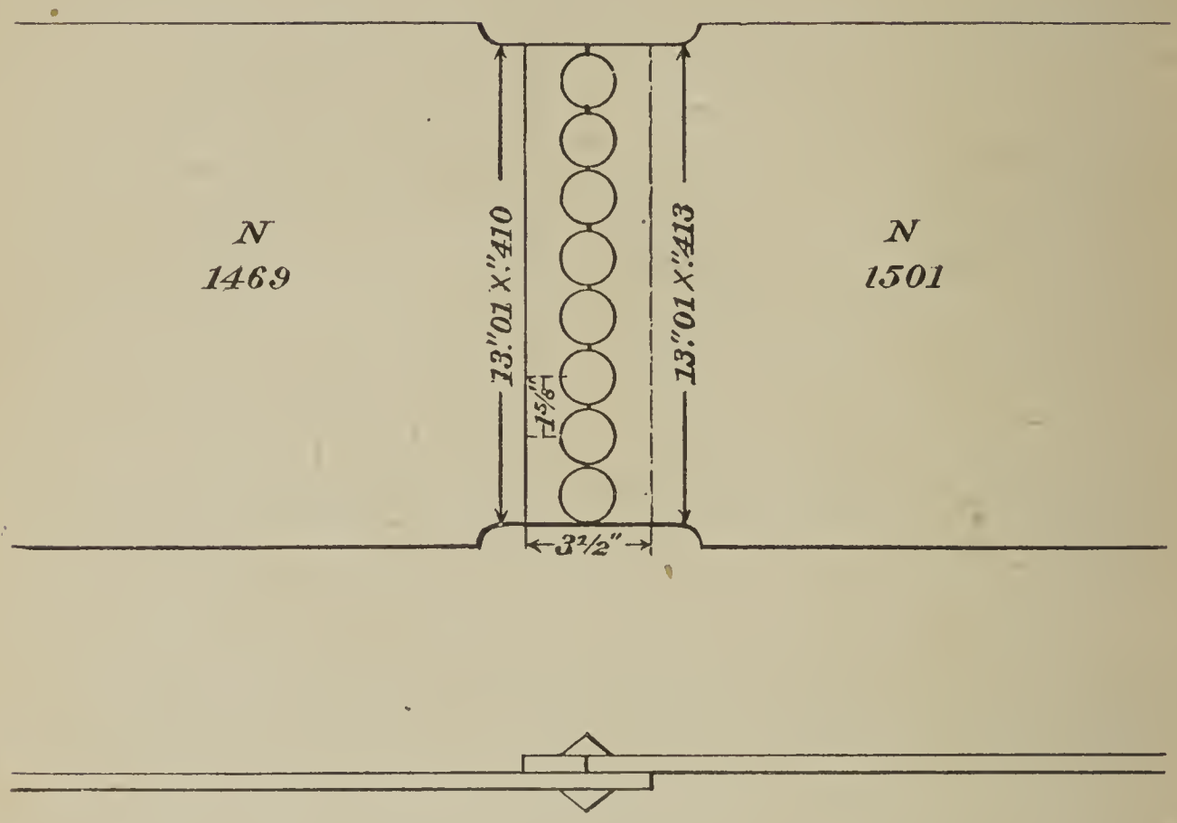
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	31,100
Tension on net section of plate	do	67,420
Compression on bearing surface of rivets	do	57,730
Shearing on rivets	do	35,880

Efficiency of joint, 52.7 per cent.

No. 5134.

($\frac{7}{16}$'' steel plates; punched holes, punch, $\frac{7}{8}$''; die $\frac{15}{16}$''; iron rivets, $1\frac{5}{8}$'' pitch.)



Areas.

Plate, gross sectional area	square inches	5.37
Plate, net sectional area	do	2.37
Plate, bearing surface of rivets	do	2.99
Rivets, shearing area	do	4.81

Tensile strength, 163,100 pounds.

Fractured plate N 1501 along line of riveting. Appearance, granular, excepting the end sections, which were silky.

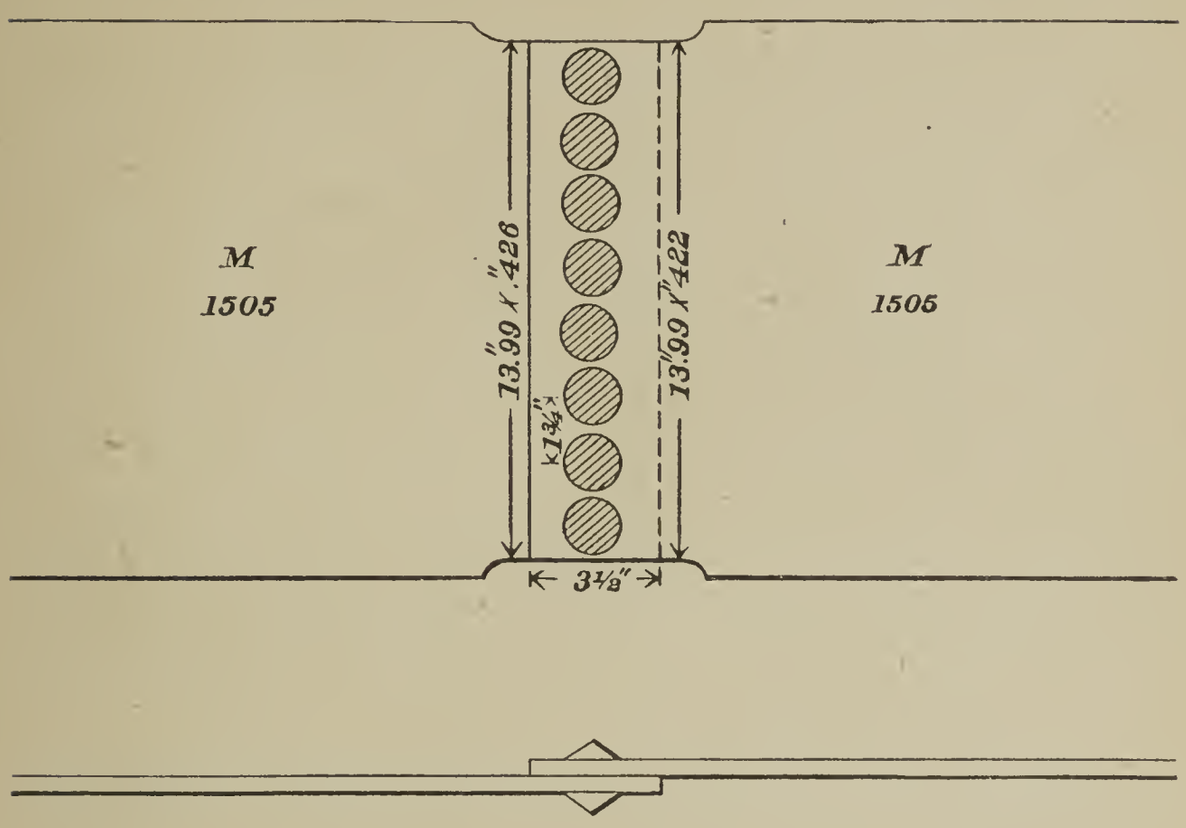
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	30,370
Tension on net section of plate	do	68,820
Compression on bearing surface of rivets	do	54,550
Shearing on rivets	do	33,910

Efficiency of joint, 49.7 per cent.

No. 5135.

($\frac{7}{16}$″ steel plates; $\frac{7}{8}$″ drilled holes; iron rivets, $1\frac{3}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.90
Plate, net sectional area	do	2.95
Plate, bearing surface of rivets	do	2.95
Rivets, shearing area	do	4.81

Tensile strength, 172,540 pounds.
Sheared the rivets.
Average elongation of rivet holes, ″.09 each.

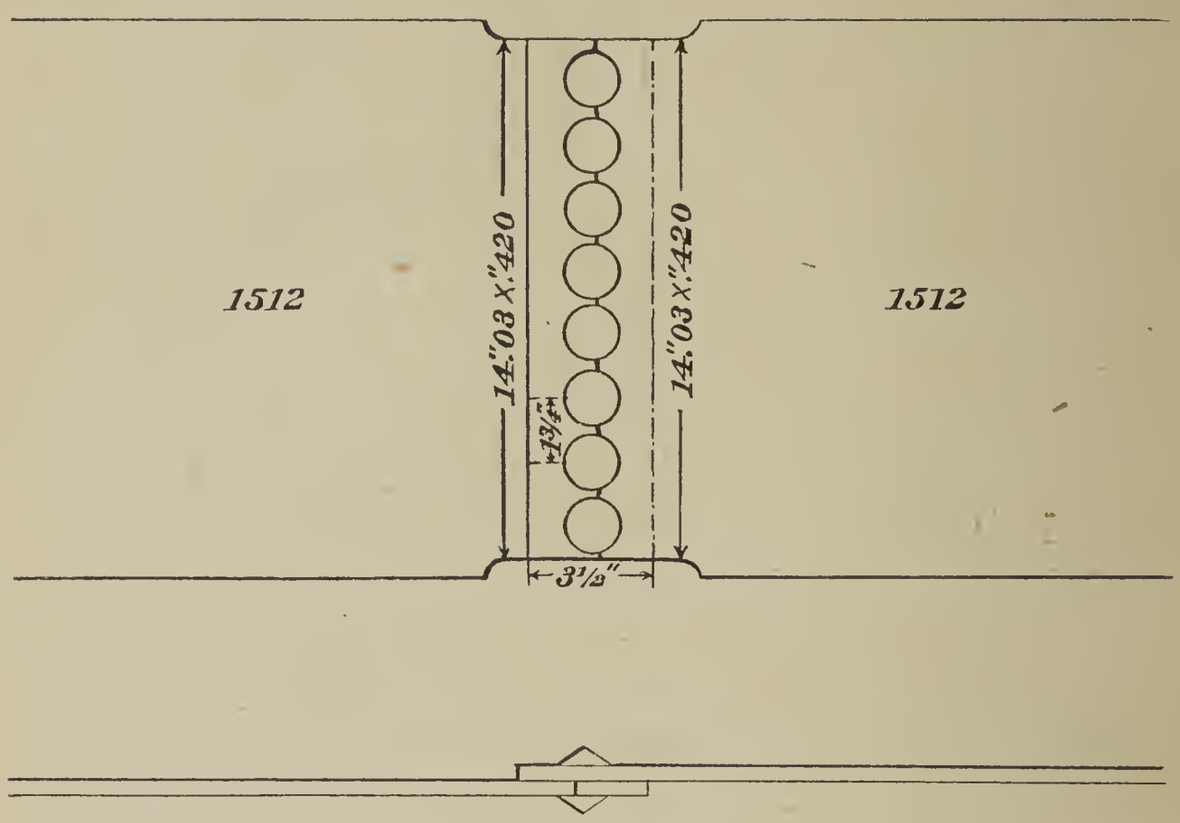
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	29,240
Tension on net section of plate	do	58,490
Compression on bearing surface of rivets	do	58,490
Shearing on rivets	do	35,870

Efficiency of joint, 47.4 per cent.

No. 5136.

($\frac{7}{16}$'' steel plates; punched holes, punch, $\frac{7}{8}$''; die, $\frac{15}{16}$''; iron rivets, $1\frac{3}{4}$'' pitch.)



Areas.

Plate, gross sectional area	square inches	5.89
Plate, net sectional area	do	2.95
Plate, bearing surface of rivets	do	2.94
Rivets, shearing area	do	4.81

Tensile strength, 187,700 pounds.

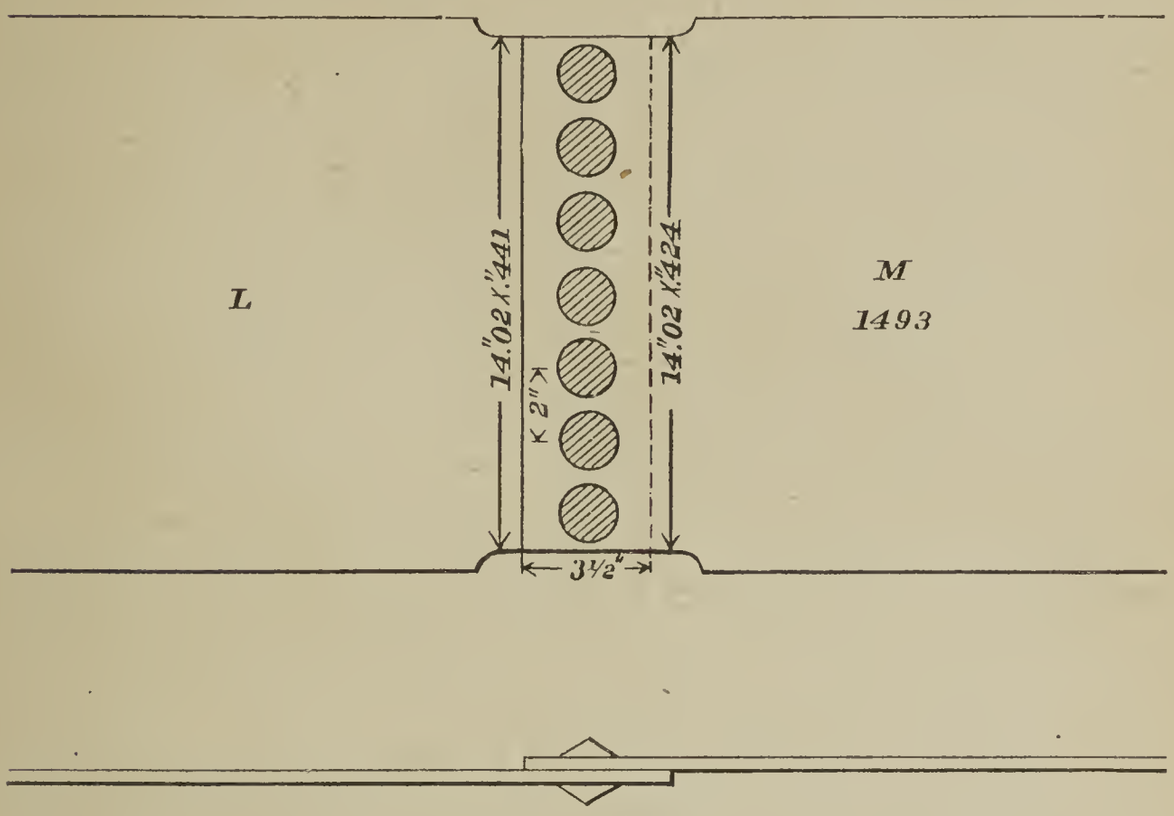
Sudden fracture with a loud report, fracturing plate along line of rivet holes. Appearance, granular.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	31,870
Tension on net section of plate	do	63,630
Compression on bearing surface of rivets	do	63,840
Shearing on rivets	do	39,020

No. 5137.

($\frac{7}{16}$″ steel plates; $\frac{7}{8}$″ drilled holes; iron rivets, 2″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.94
Plate, net sectional area	do	3.35
Plate, bearing surface of rivets	do	2.60
Rivets, shearing area	do	4.21

Tensile strength, 163,800 pounds.

Sheared the rivets.

Average elongation of rivet holes: Plate L, ″.01+; plate M 1493, ″.06.

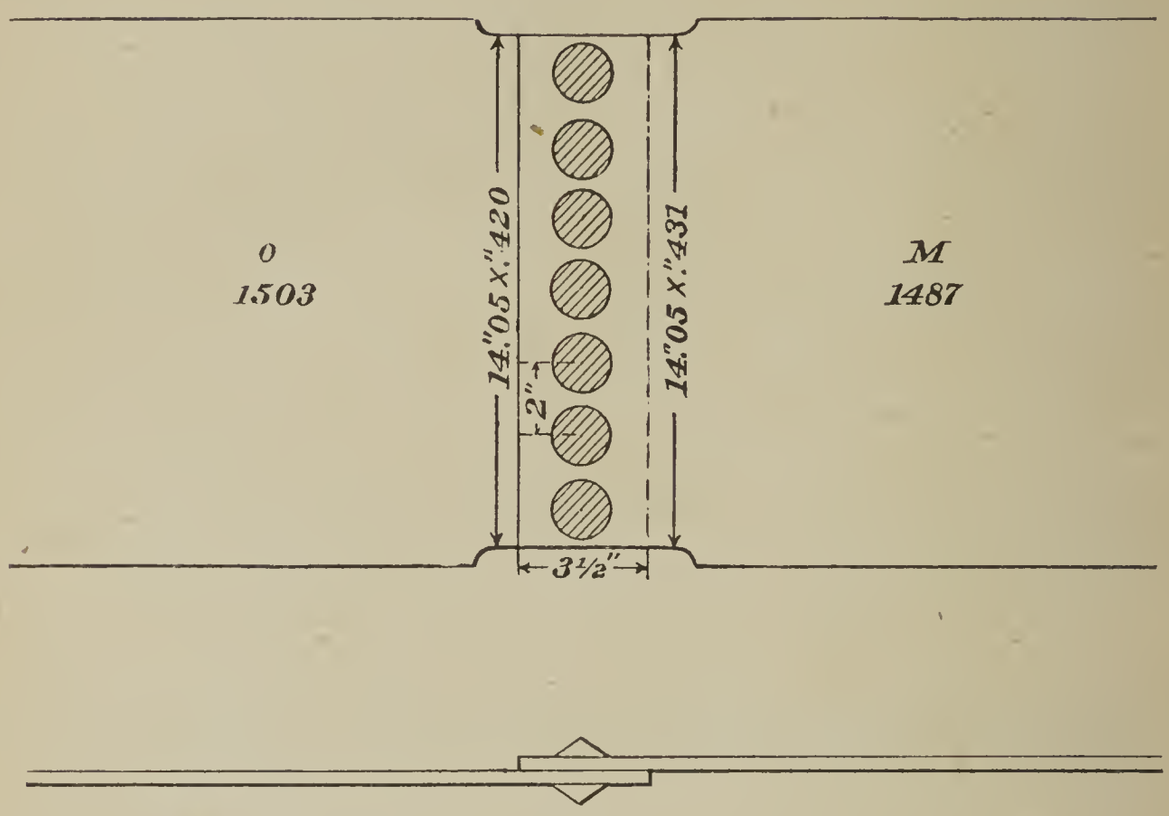
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	27,580
Tension on net section of plate	do	48,900
Compression on bearing surface of rivets	do	63,000
Shearing on rivets	do	38,910

Efficiency of joint, 46.4 per cent.

No. 5138.

($\frac{7}{16}$″ steel plates; punched holes, punch, $\frac{7}{8}$″; die, $\frac{15}{16}$″; iron rivets, 2″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.90
Plate, net sectional area	do	3.24
Plate, bearing surface of rivets	do	2.66
Rivets, shearing area	do	4.21

Tensile strength, 168,300 pounds.
Sheared the rivets.
Average elongation of rivet holes, ″.01±.

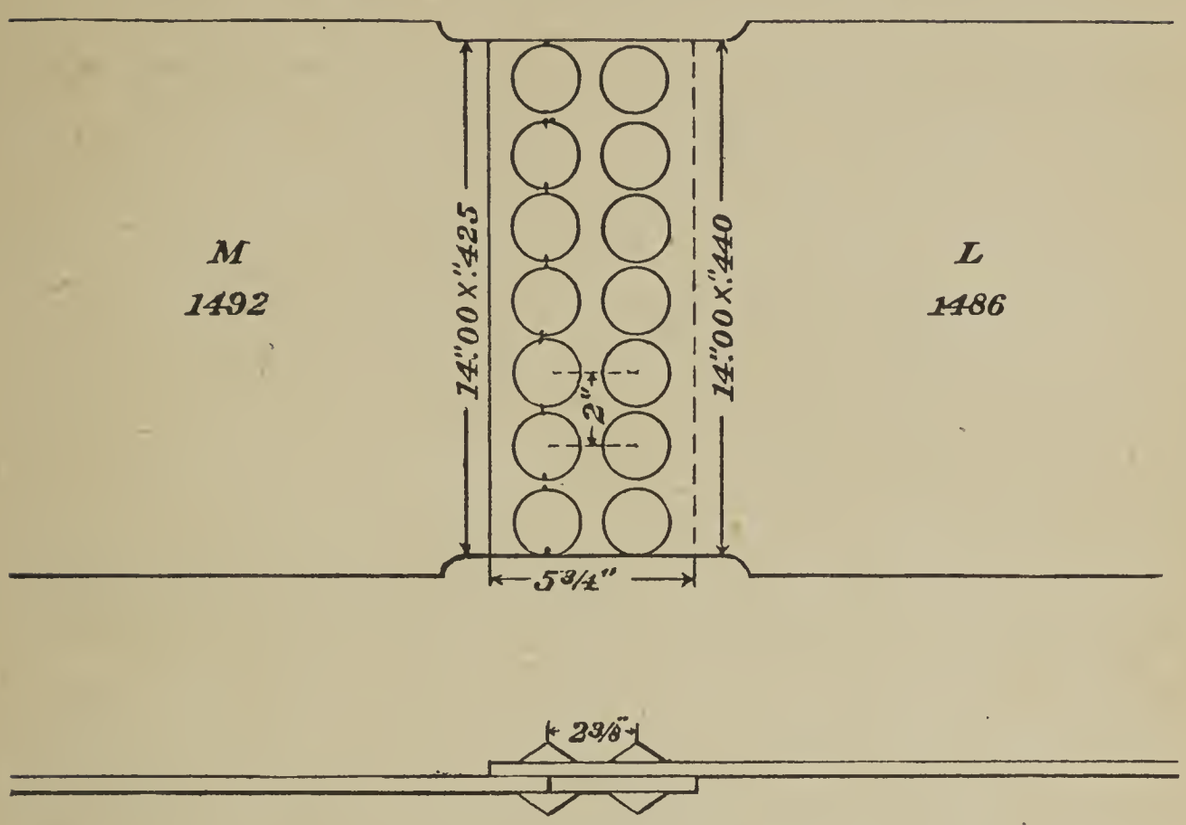
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	28,530
Tension on net section of plate	do	51,940
Compression on bearing surface of rivets	do	63,270
Shearing on rivets	do	39,980

Efficiency of joint, 53.9 per cent.

No. 5149.

($\frac{7}{16}$″ steel plates; $\frac{7}{8}$″ drilled holes; iron rivets, 2″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.95
Plate, net sectional area	do	3.35
Plate, bearing surface of rivets	do	5.21
Rivets, shearing area	do	8.41

Tensile strength, 241,700 pounds.

Fractured plate M 1492 along first row of rivet holes. Appearance, silky. Average elongation of rivet holes: Plate M, first row, ".36*; second row, ".00. Plate L, first row, ".10; second row, ".00.

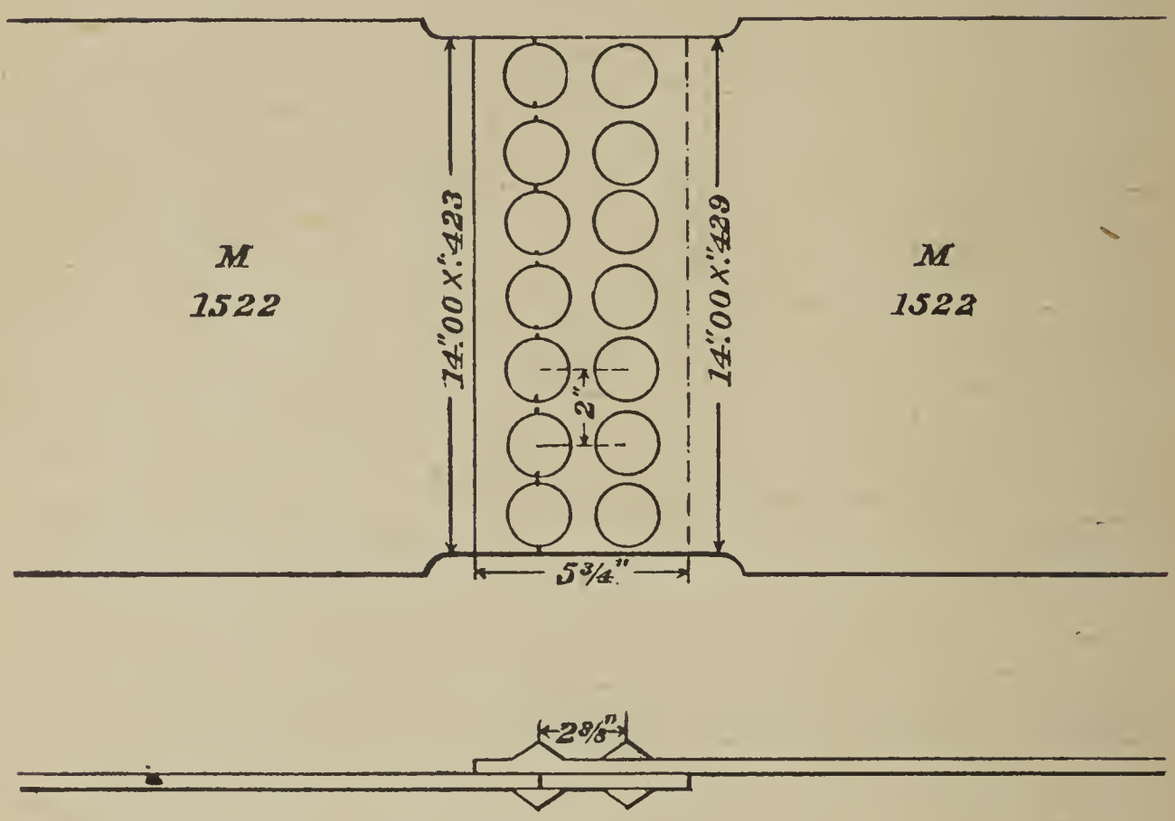
* *Maximum stress on joint.*

Tension on gross section of plate	pounds per square inch	40,620
Tension on net section of plate	do	72,150
Compression on bearing surface of rivets	do	46,390
Shearing on rivets	do	28,740

Efficiency of joint, 65.8 per cent.

No. 5150.

($\frac{7}{16}$″ steel plates; punched holes, punch, $\frac{7}{8}$″, die, $\frac{15}{16}$″; iron rivets, 2″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.93
Plate, net sectional area	do	3.24
Plate, bearing surface of rivets	do	5.36
Rivets, shearing area	do	8.41

Tensile strength, 224,800 pounds.

Fractured plate along first row of rivet holes. Appearance, silky.

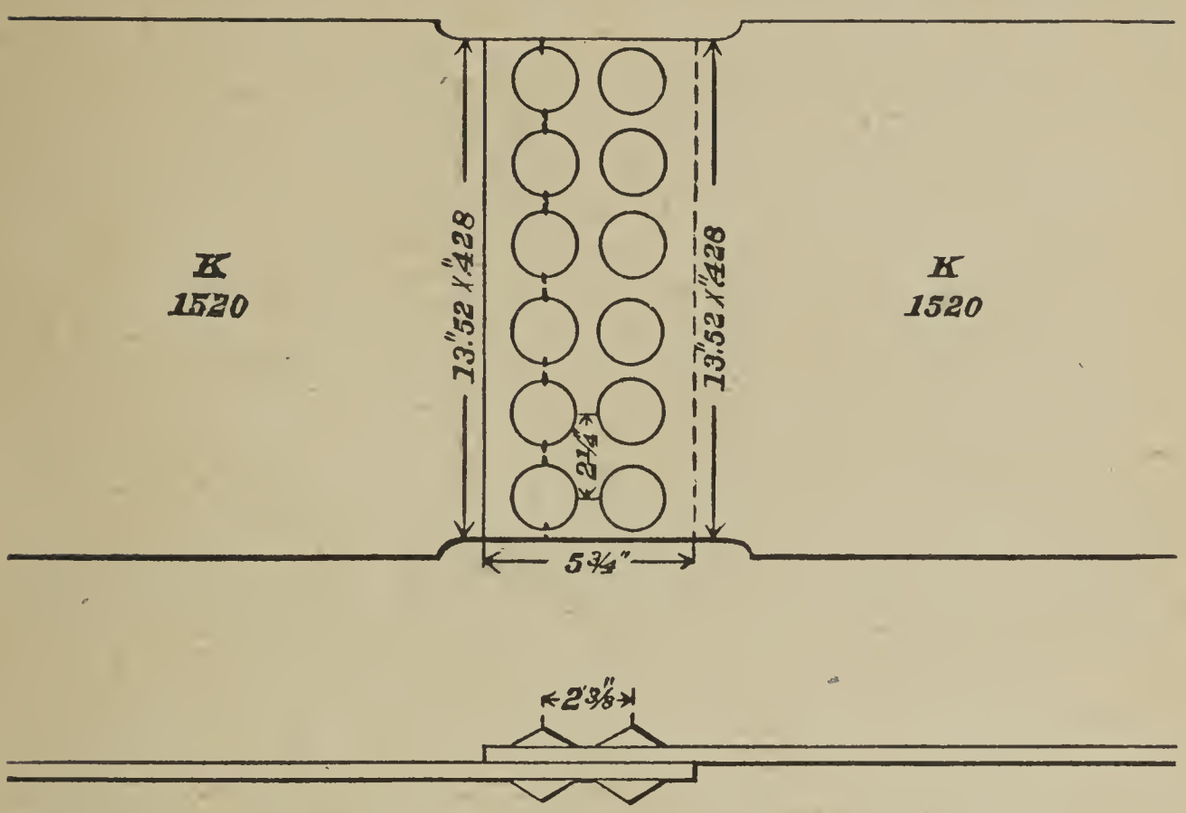
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	37,910
Tension on net section of plate	do	69,380
Compression on bearing surface of rivets	do	41,940
Shearing on rivets	do	26,730

Efficiency of joint, 61.4 per cent.

No. 5151.

($\frac{7}{16}$″ steel plates; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{1}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.79
Plate, net sectional area	do	3.54
Plate, bearing surface of rivets	do	4.49
Rivets, shearing area	do	7.21

Tensile strength, 249,820 pounds.
Fractured plate along first row of rivet holes. Appearance, silky.

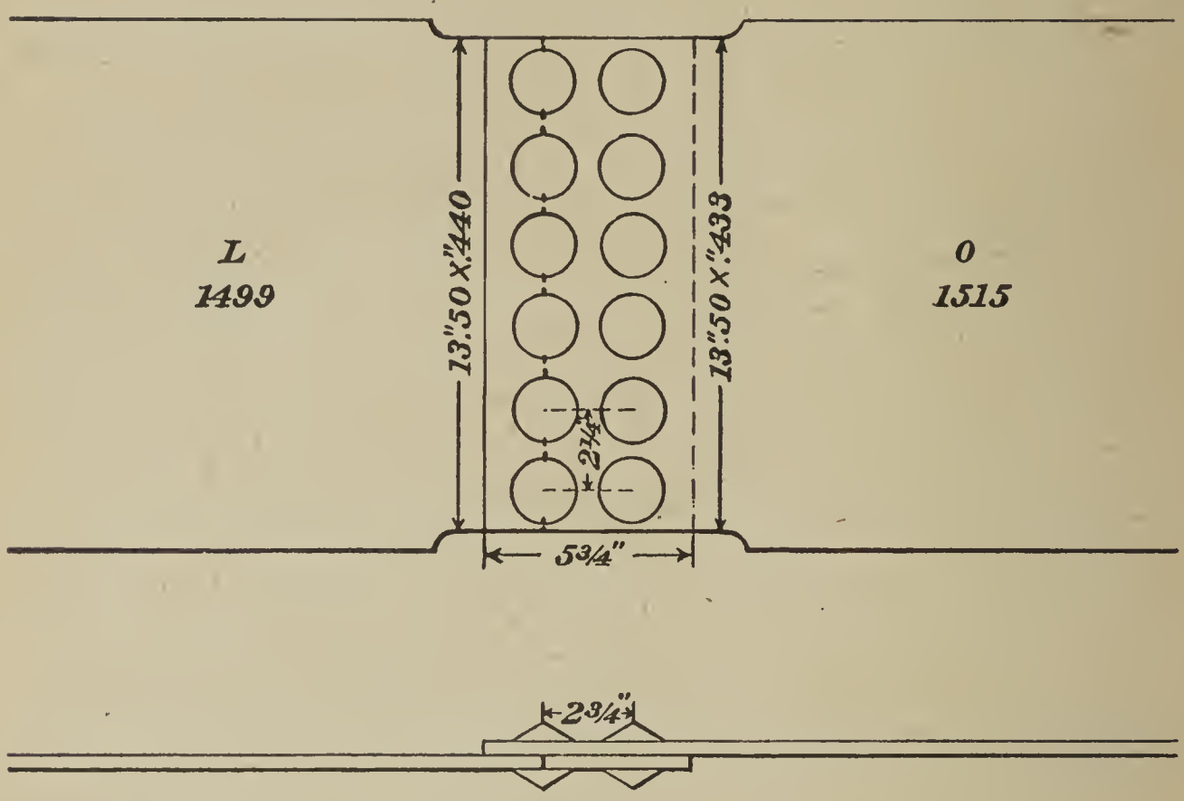
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	43,150
Tension on net section of plate	do	70,570
Compression on bearing surface of rivets	do	55,640
Shearing on rivets	do	34,650

Efficiency of joint, 73.1 per cent.

No. 5152.

($\frac{7}{16}$″ steel plates; punched holes, punch, $\frac{7}{8}$″; die, $\frac{15}{16}$″; iron rivets, $2\frac{1}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.94
Plate, net sectional area	do	3.55
Plate, bearing surface of rivets	do	4.78
Rivets, shearing area	do	7.21

Tensile strength, 230,900 pounds.

Fractured plate L 1499 along first row of rivet holes. Fractured suddenly without warning. Appearance, granular.

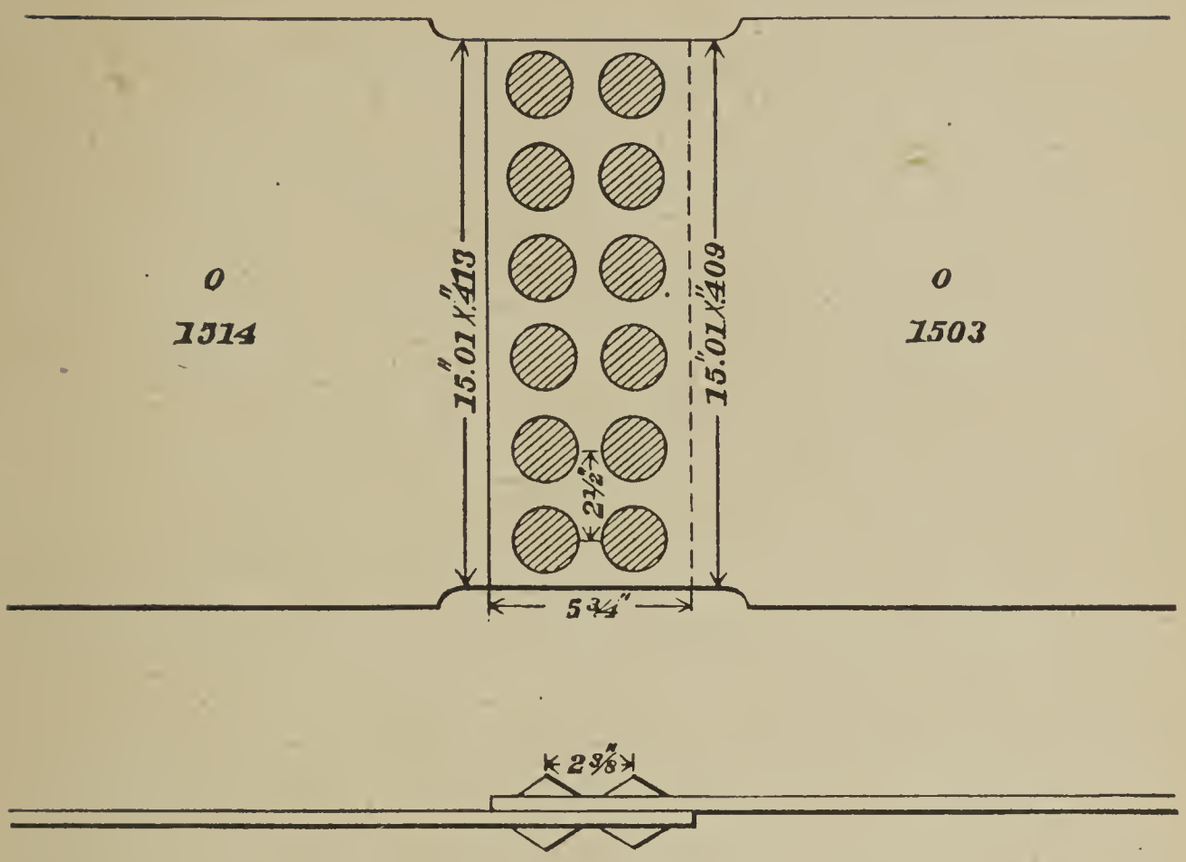
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	38,870
Tension on net section of plate	do	65,040
Compression on bearing surface of rivets	do	48,310
Shearing on rivets	do	32,020

Efficiency of joint, 65.4 per cent.

No. 5153.

($\frac{7}{16}$″ steel plates; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches..	6.14
Plate, net sectional area	do....	3.99
Plate, bearing surface of rivets	do....	4.29
Rivets, shearing area	do....	7.21

Tensile strength, 267,300 pounds.

Sheared the rivets.

Average elongation of rivet holes: First row, ″.12; second row, ″.01 in each plate.

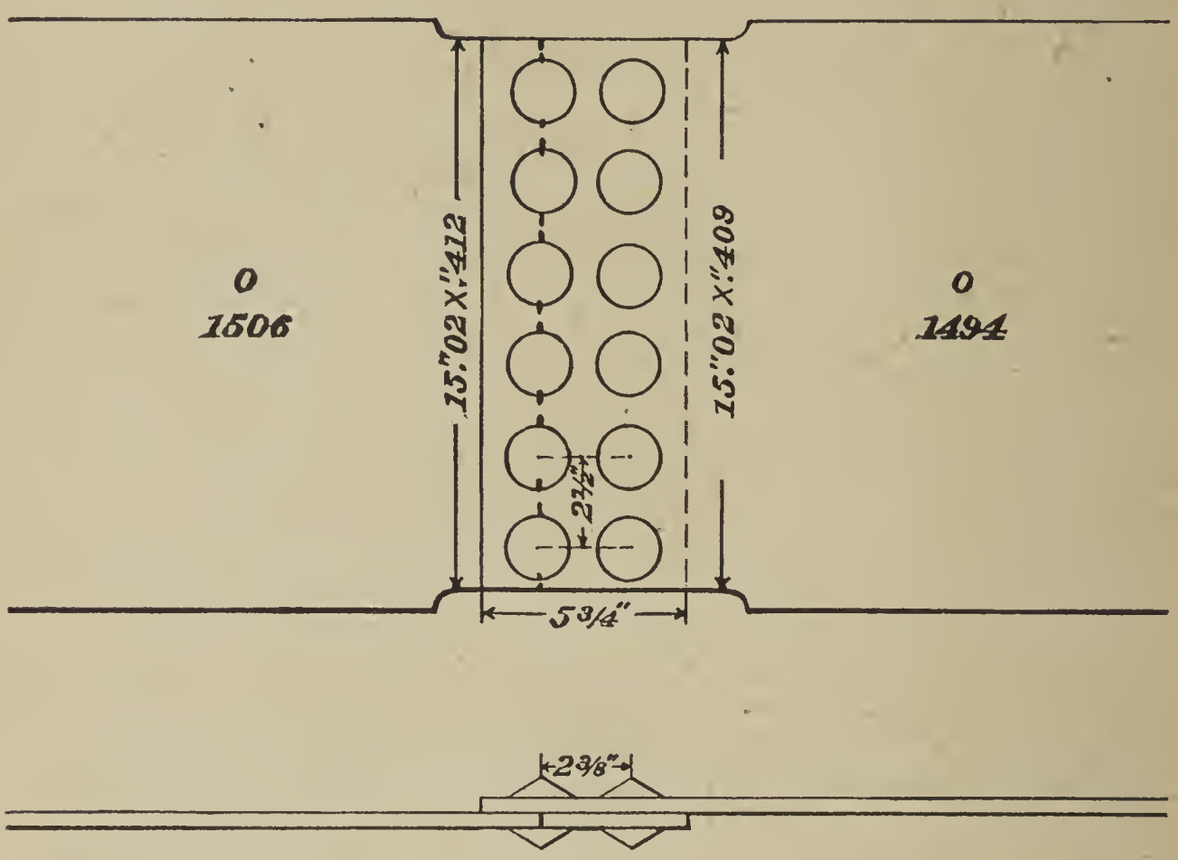
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	43,530
Tension on net section of plate	do....	66,990
Compression on bearing surface of rivets	do....	62,310
Shearing on rivets	do....	37,070

Efficiency of joint, 82.3 per cent.

No. 5154.

($\frac{7}{16}$″ steel plates; punched holes, punch, $\frac{7}{8}$″; die, $\frac{15}{16}$″; iron rivets, $2\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	6.19
Plate, net sectional area	do	3.95
Plate, bearing surface of rivets	do	4.48
Rivets, shearing area	do	7.21

Tensile strength, 249,980 pounds.

Fractured plate O 1506 along first row of rivet holes. Appearance, granular, excepting one end section, which had a silky appearance. The granular sections showed a radiant appearance with the center of radiation on the side nearest the middle of the plate.

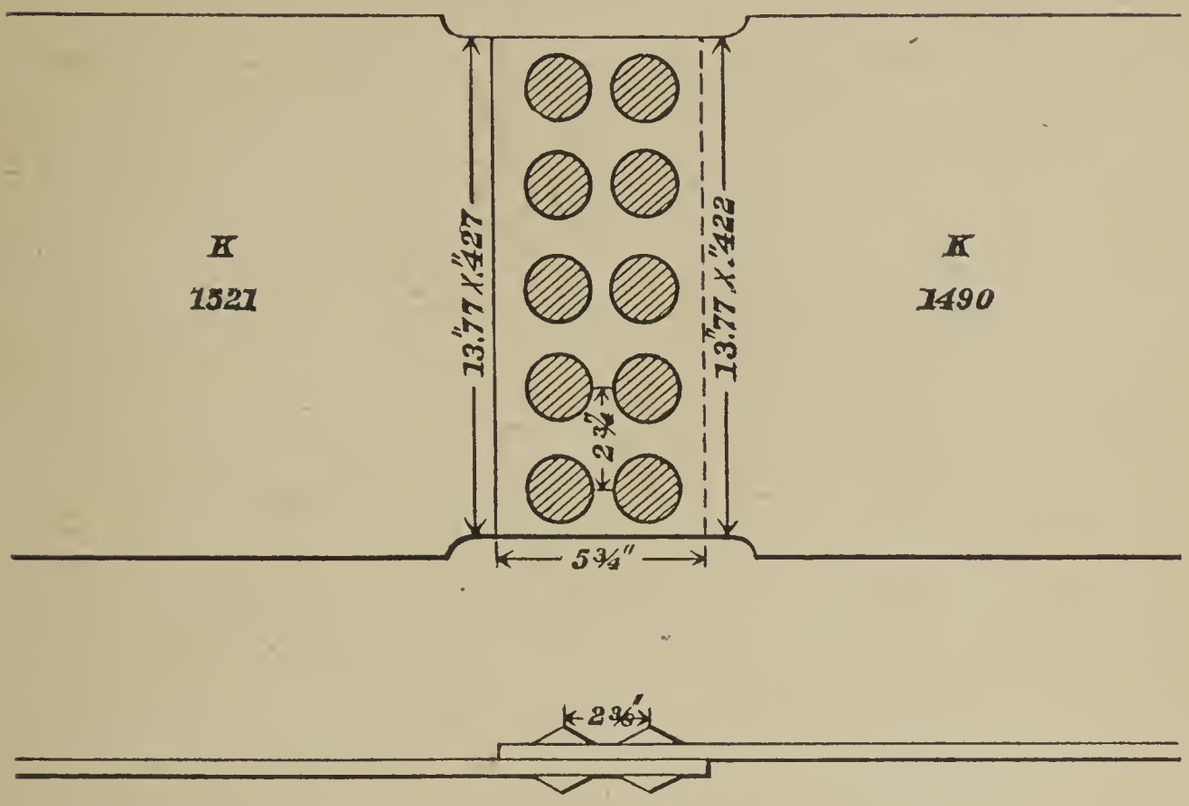
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	40,380
Tension on net section of plate	do	63,290
Compression on bearing surface of rivets	do	55,800
Shearing on rivets	do	34,670

Efficiency of joint, 76.3 per cent.

No. 5156.

($\frac{7}{16}$″ steel plates; $\frac{7}{8}$″ drilled holes; iron rivets, $3\frac{3}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.81
Plate, net sectional area	do	3.96
Plate, bearing surface of rivets	do	3.69
Rivets, shearing area	do	6.01

Tensile strength, 225,700 pounds.

Sheared the rivets.

Average elongation of rivet holes: First row, ″.09 each; second row, ″.01 each.

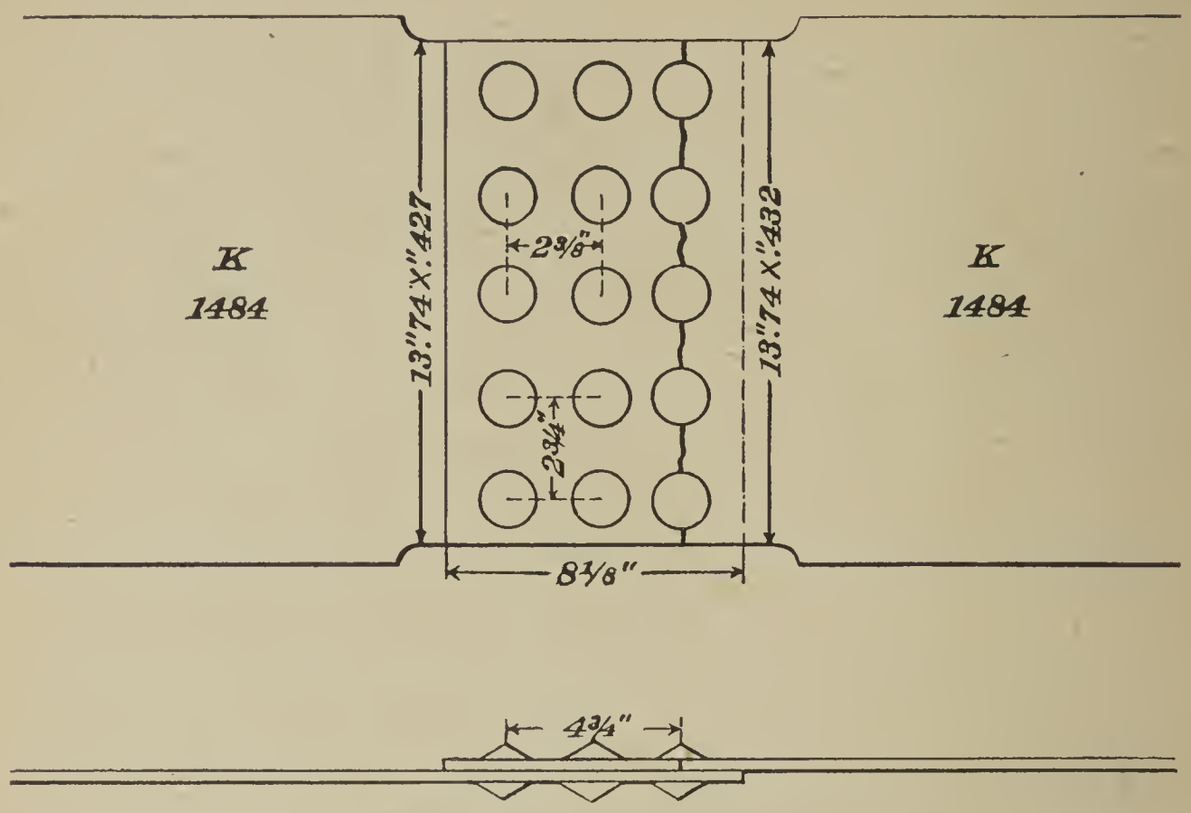
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	38,859
Tension on net section of plate	do	56,990
Compression on bearing surface of rivets	do	61,170
Shearing on rivets	do	37,550

Efficiency of joint, 65.8 per cent.

No. 5157.

($\frac{7}{16}$″ steel plates; $\frac{7}{8}$″ drilled holes; iron rivets, $2\frac{3}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.93
Plate, net sectional area	do	4.04
Plate, bearing surface of rivets	do	5.66
Rivets, shearing area	do	9.02

Tensile strength, 271,100 pounds.

Fractured plate along first row of rivet holes. Appearance, silky, lamellar.

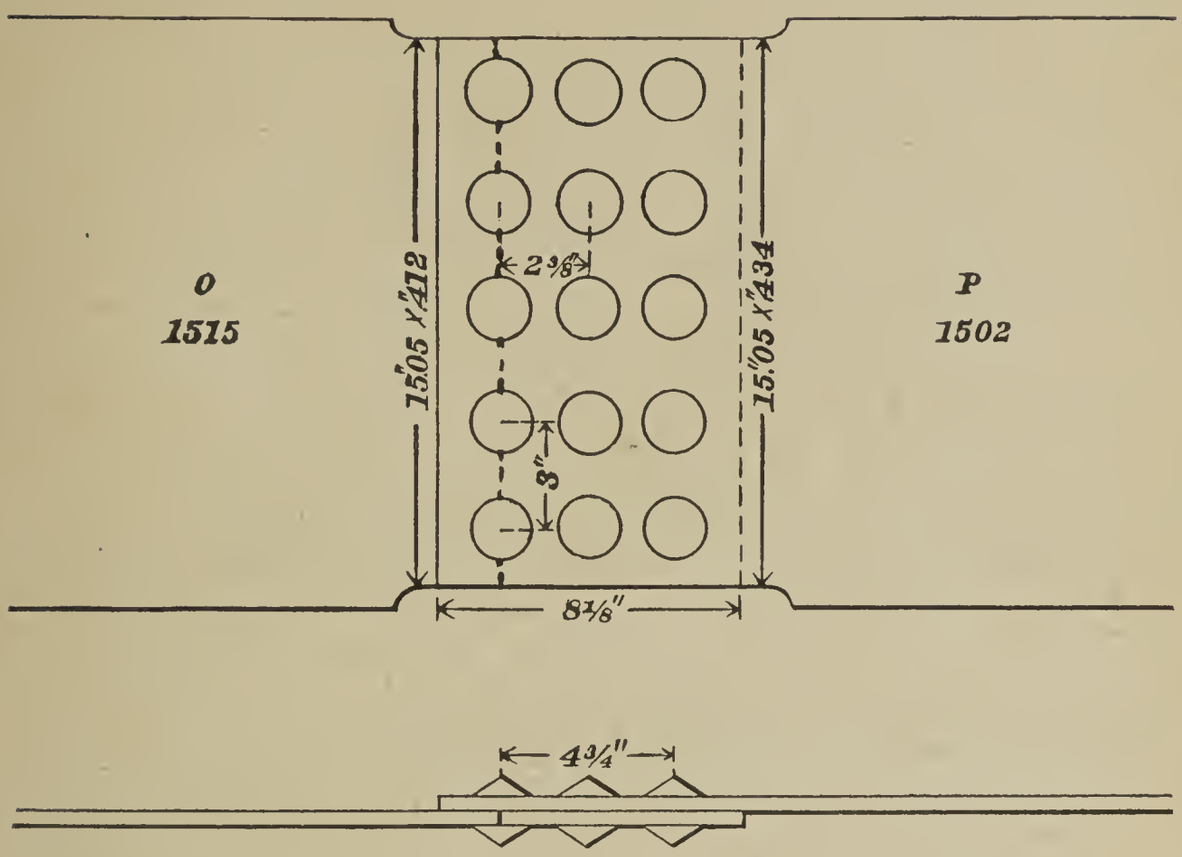
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	45,720
Tension on net section of plate	do	67,100
Compression on bearing surface of rivets	do	47,900
Shearing on rivets	do	30,060

Efficiency of joint, 77.5 per cent.

No. 5158.

($\frac{7}{16}$″ steel plates; $\frac{7}{8}$″ drilled holes; iron rivets, 3″ pitch.)



Areas.

Plate, gross sectional area	square inches	6.20
Plate, net sectional area	do	4.40
Plate, bearing surface of rivets	do	5.41
Rivets, shearing area	do	9.02

Tensile strength, 301,980 pounds.

Fractured plate O 1515 along first row of rivet holes. Appearance, silky.

Average elongation of rivet holes: In fractured plate, first row, ″.36*; second row, ″.02; third row, ″.00. In plate not fractured, first row, ″.16; second row, ″.00: third row, ″.00.

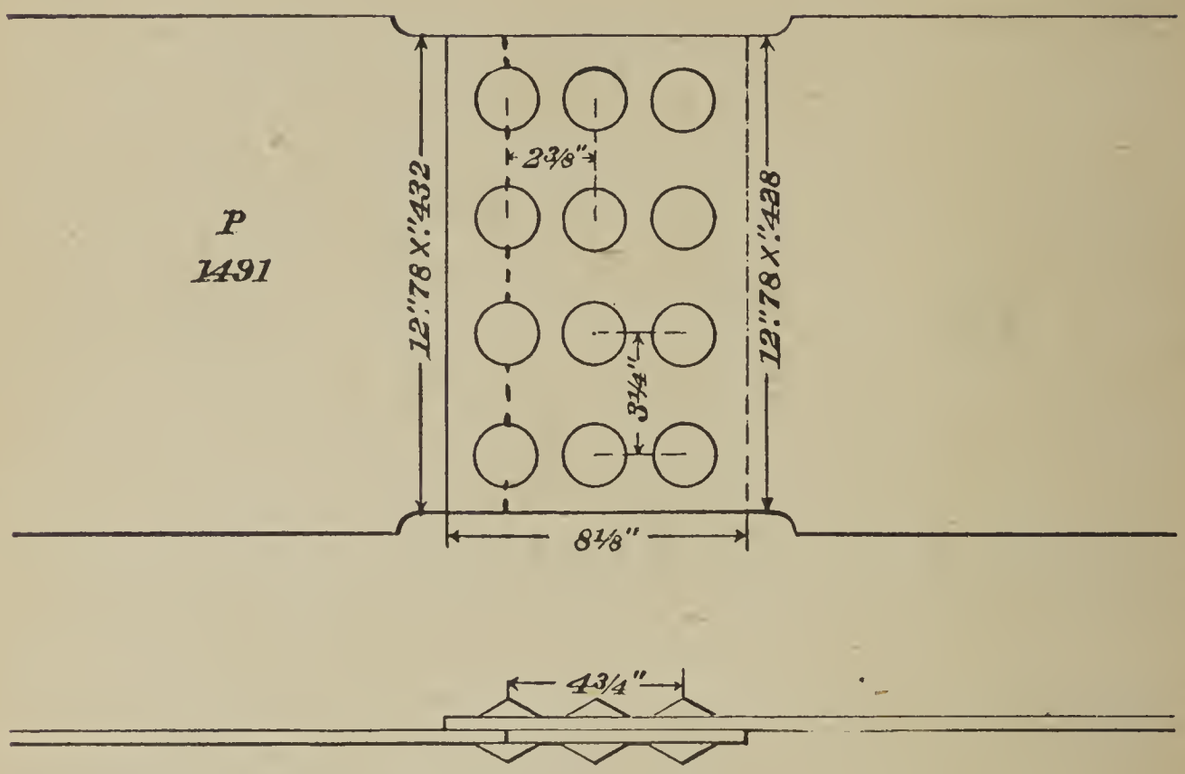
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	48,710
Tension on net section of plate	do	68,630
Compression on bearing surface of rivets	do	55,820
Shearing on rivets	do	33,480

Efficiency of joint, 92.1 per cent.

No. 5159.

($\frac{7}{16}$″ steel plates; $\frac{7}{8}$″ drilled holes; iron rivets, $3\frac{1}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.52
Plate, net sectional area	do	4.01
Plate, bearing surface of rivets	do	4.54
Rivets, shearing area	do	7.21

Tensile strength, 265,200 pounds.

Fractured plate P 1491 along first row of rivet holes. Appearance, silky.

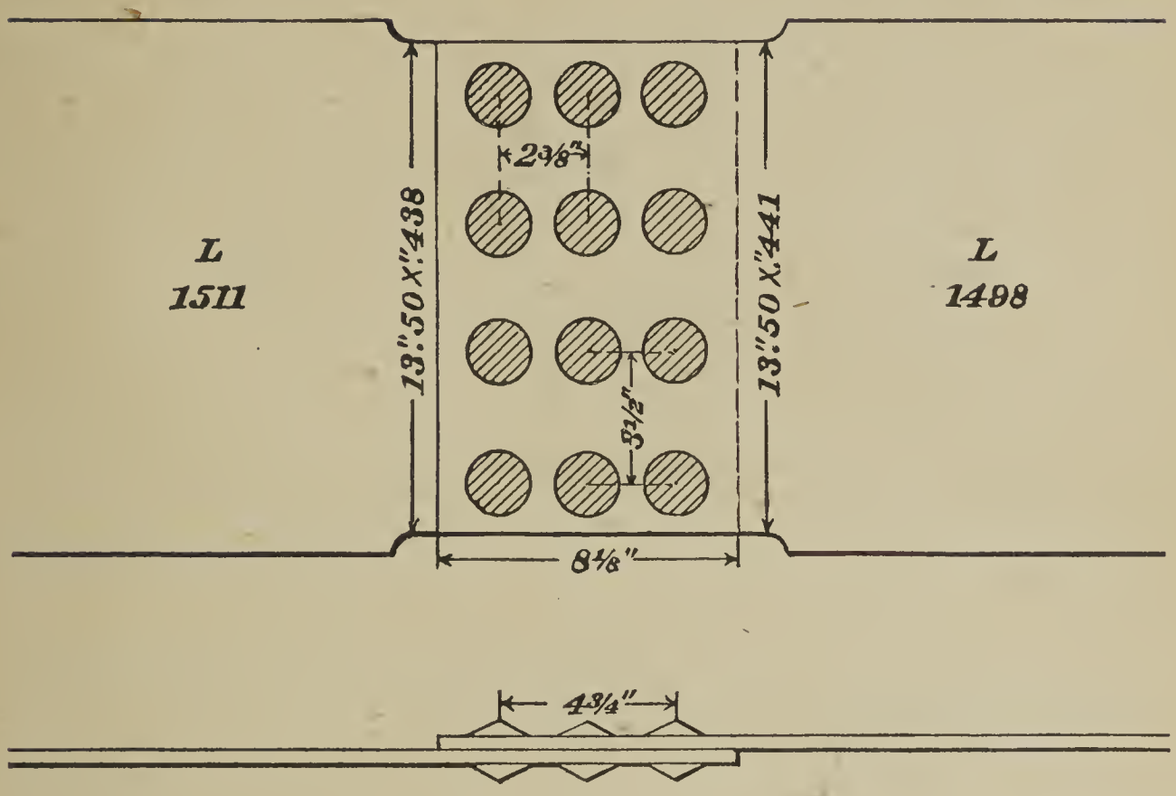
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	48,040
Tension on net section of plate	do	66,130
Compression on bearing surface of rivets	do	58,410
Shearing on rivets	do	36,780

Efficiency of joint, 82.7 per cent.

No. 5160.

($\frac{7}{16}$″ steel plates; $\frac{7}{8}$″ drilled holes; iron rivets, $3\frac{1}{2}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.91
Plate, net sectional area	do	4.38
Plate, bearing surface of rivets	do	4.60
Rivets, shearing area	do	7.21

Tensile strength, 274,400 pounds.

Sheared the rivets.

Average elongation of rivet holes: First row, ″.15; second row,″.04; third row, ″.01.

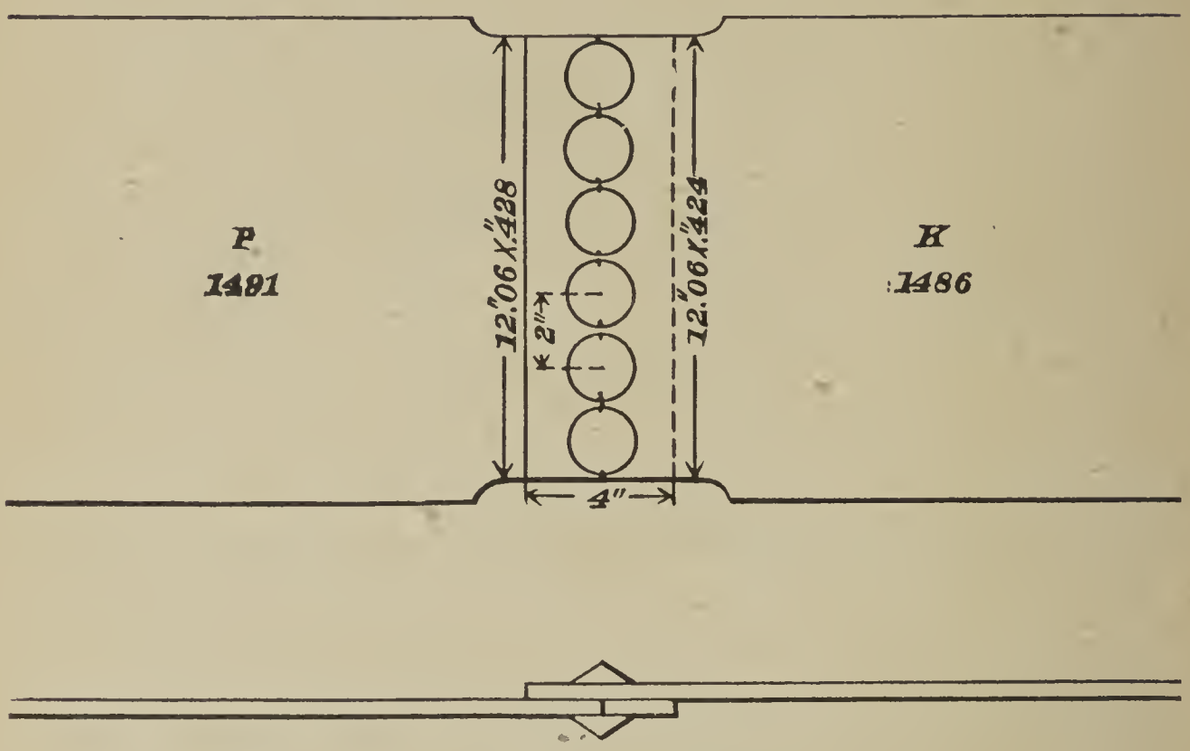
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,430
Tension on net section of plate	do	62,650
Compression on bearing surface of rivets	do	59,650
Shearing on rivets	do	38,060

Efficiency of joint, 78.2 per cent.

No. 5139.

($\frac{7}{16}$″ steel plates; $1\frac{1}{4}$″ drilled holes; iron rivets, 2″ pitch.)



Areas.

Plate, gross sectional area	square inches	5.16
Plate, net sectional area	do	1.95
Plate, bearing surface of rivets	do	3.21
Rivets, shearing area	do	7.36

Tensile strength, 145,480 pounds.
Fractured plate P along line of rivet holes. Appearance, silky.

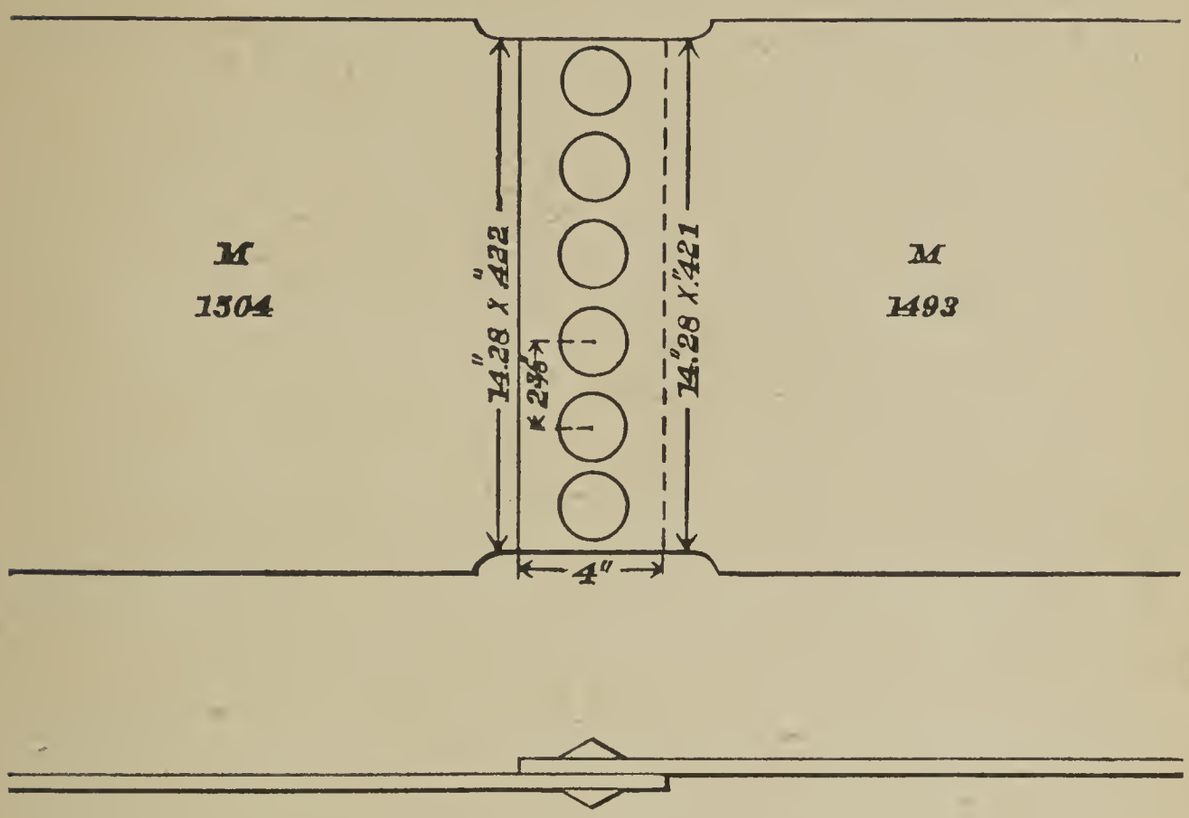
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	28,190
Tension on net section of plate	do	74,610
Compression on bearing surface of rivets	do	45,320
Shearing on rivets	do	19,770

Efficiency of joint, 48.5 per cent.

No. 5140.

($\frac{7}{16}$″ steel plates; $1\frac{1}{4}$″ drilled holes; iron rivets, $2\frac{3}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	6.01
Plate, net sectional area	do	2.85
Plate, bearing surface of rivets	do	3.16
Rivets, shearing area	do	7.36

Tensile strength, 209,440 pounds.
Pulled off rivet heads. Plates not fractured.
Elongation of rivet holes, about ″.22 each.

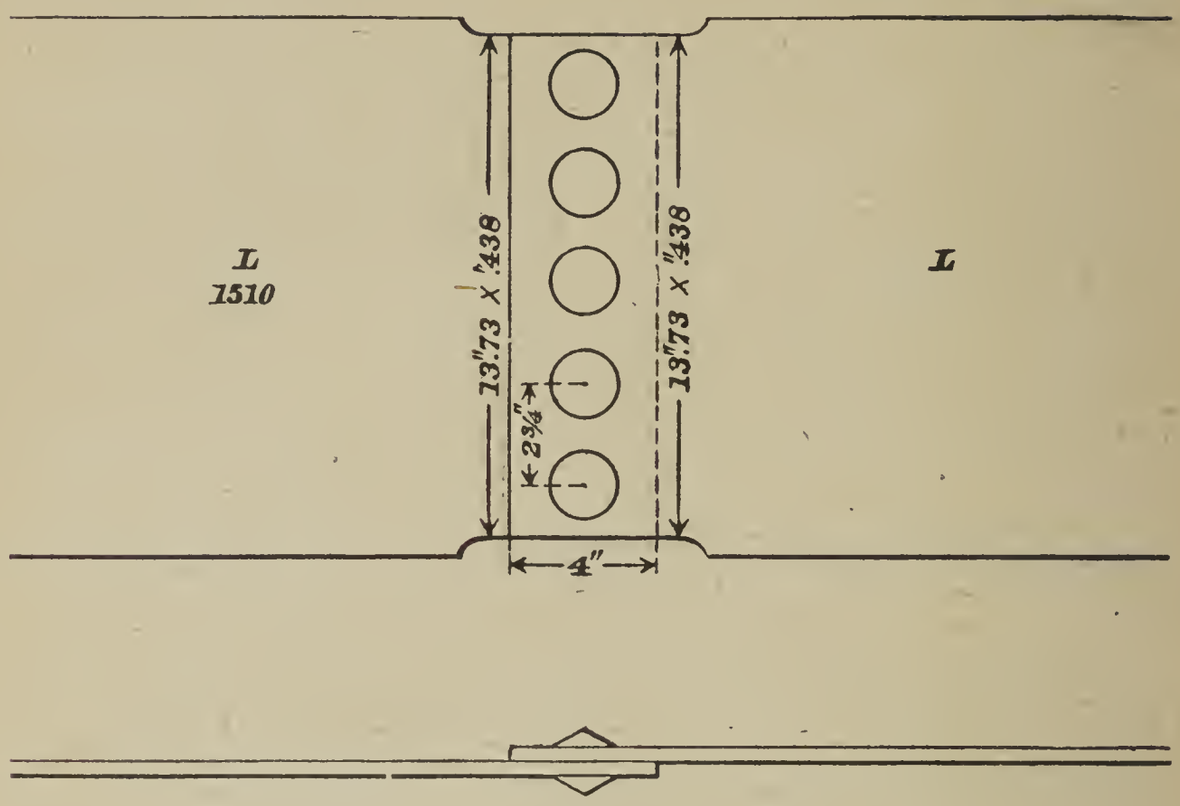
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	34,850
Tension on net section of plate	do	73,490
Compression on bearing surface of rivets	do	66,280
Shearing on rivets	do	28,460

Efficiency of joint, 56.5 per cent.

No. 5141.

($\frac{7}{16}$″ steel plates; $1\frac{1}{4}$″ drilled holes; iron rivets, $2\frac{3}{4}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	..	6.01
Plate, net sectional area	do	....	3.28
Plate, bearing surface of rivets	do	....	2.74
Rivets, shearing area	do	....	6.14

Tensile strength, 201,700 pounds.
Pulled off rivet heads; plates not fractured.
Average elongation of rivet holes, ″.19 each.
Bent plates at lap 15 degrees.

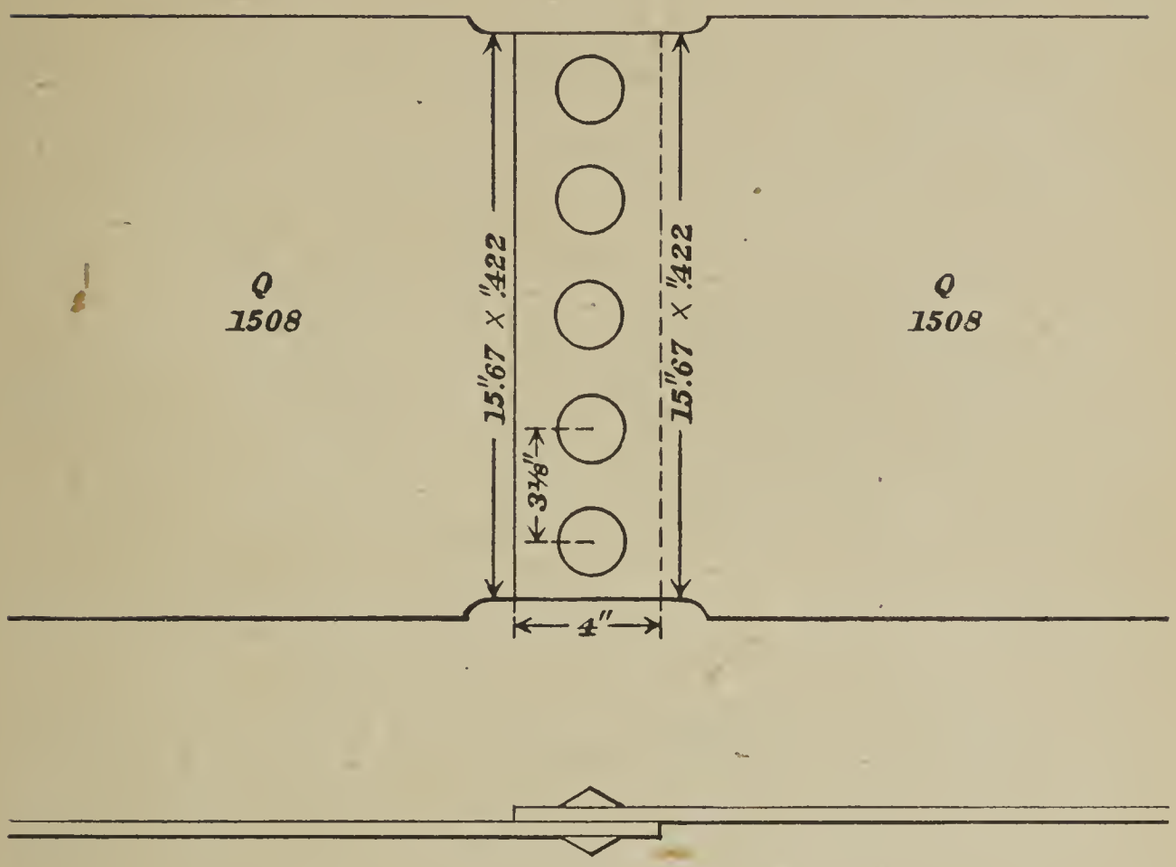
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	..	33,560
Tension on net section of plate	do	....	61,490
Compression on bearing surface of rivets	do	....	73,610
Shearing on rivets	do	....	32,850

Efficiency of joint, 56.5 per cent.

No. 5142.

($\frac{7}{16}$″ steel plates; $1\frac{1}{4}$″ drilled holes; iron rivets, $3\frac{1}{8}$″ pitch.)



Areas.

Plate, gross sectional area	square inches	6.61
Plate, net sectional area	do	3.97
Plate, bearing surface of rivets	do	2.64
Rivets, shearing area	do	6.14

Tensile strength, 201,100 pounds.

Pulled off rivet heads. Plates not fractured. Average elongation of rivet holes, ″.16 each.

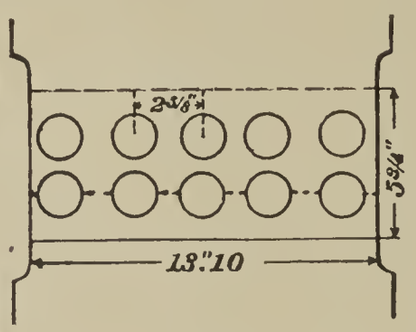
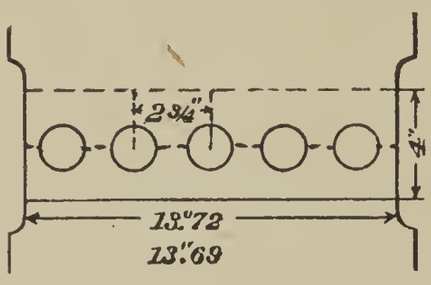
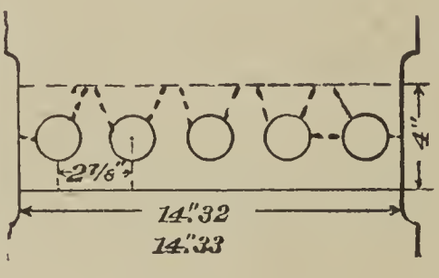
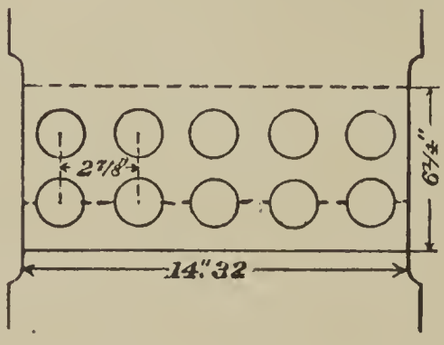
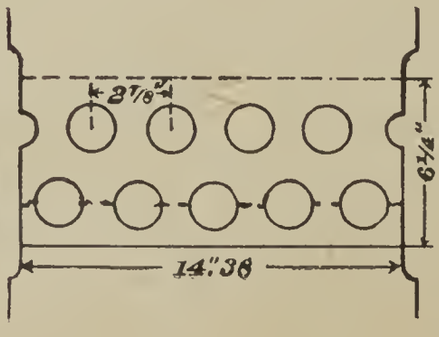
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	30,420
Tension on net section of plate	do	50,650
Compression on bearing surface of rivets	do	76,170
Shearing on rivets	do	32,750

Efficiency of joint, 53.4 per cent.

¼″ PLATE.

[Figures in heavy faced type denote manner of failure.]

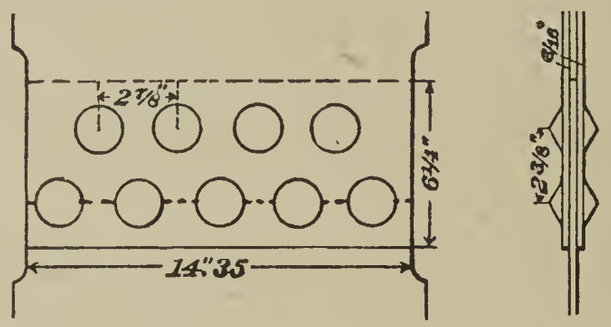
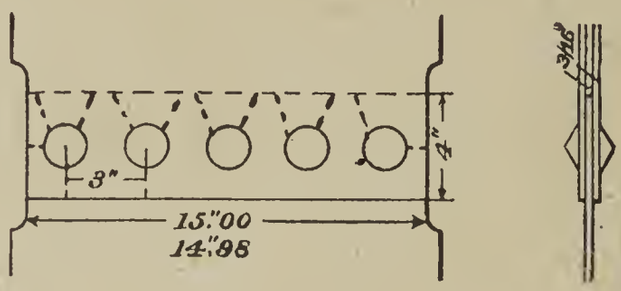
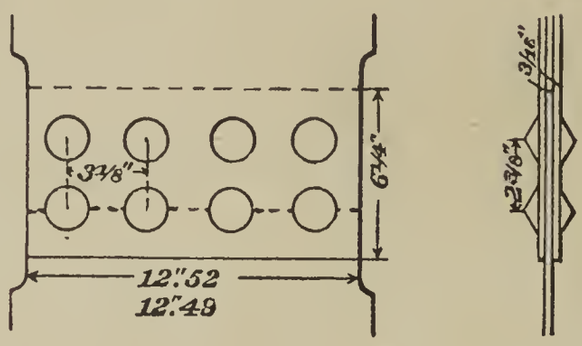
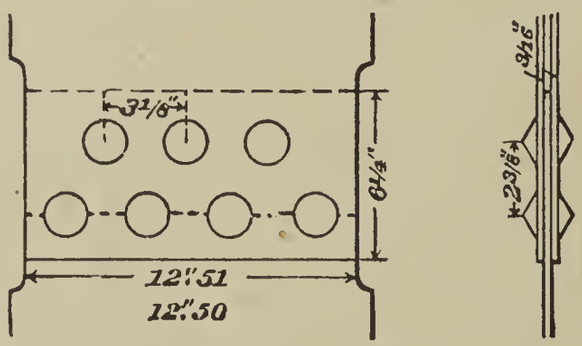
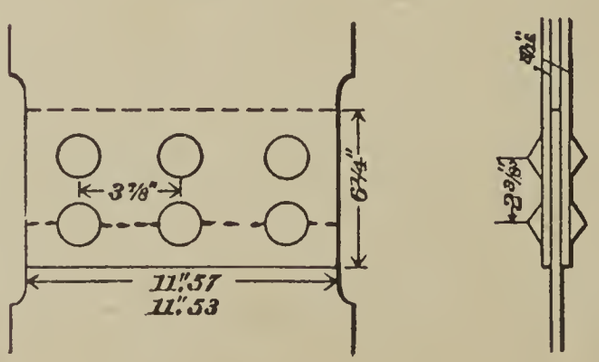
No. of test.	Sheet letters. Plate.	Covers.		Style of joint.	Nominal thickness— Plate.	Covers.	Size and kind of holes.
					Inch.	*Inch.*	*Inch.*
4911	K	C	C		¼	3/16	⅝ drilled ...
4912	L	C	C		¼	3/16	⅞ drilled ...
4913	H	C	D		¼	3/16	⅞ drilled ...
4914	L	D	D		¼	3/16	⅞ drilled ...
4915	M	E	E		¼	3/16	⅞ drilled ...
4916	M	D	D		¼	3/16	⅞ drilled ...
4919	L	E	D		¼	3/16	⅞ drilled ...
4920	L	E	E		¼	3/16	⅞ drilled ...
4927	M	D	E		¼	3/16	⅞ drilled ...

$\frac{1}{4}$″ PLATE.

Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.253	3.31	2.52	1.58	6.14	58,150	49,090	**64,480**	102,850	26,470	84.4
.253	3.31	2.52	1.58	6.14	61,470	51,960	**68,250**	108,860	28,010	84.5
.247	3 39	2.31	1.08	6.01	59,180	44,180	**65,760**	140,650	25,270	75.7
.248	3.40	2.31	1.09	6.01	61,470	43,500	**64,030**	135,690	24,610	70.8
.247	3.54	2.46	1.08	6.01	58,170	46,300	66,630	**151,780**	27,270	79.6
.247	3.54	2.46	1.08	6.01	58,170	43,500	62,590	**142,570**	25,620	74.8
.247	3.54	2.46	2.16	12.02	61,470	46,810	**67,370**	76,720	13,790	76.1
.249	3.57	2.48	2.18	12.02	61,470	45,700	**65,790**	74,840	13,570	74.3
.250	3.59	2.50	1.97	10.82	58,170	48,150	**69,140**	87,740	15,980	80.3

¼″ PLATE.

[Figures in heavy-faced type denote manner of failure.]

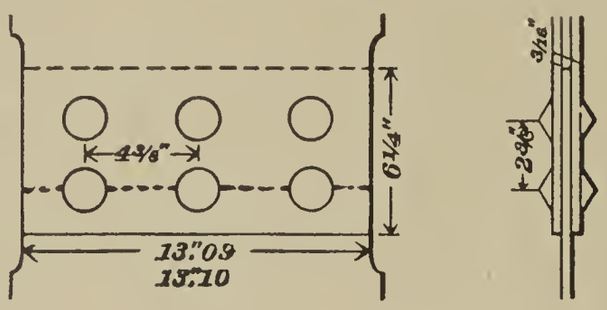
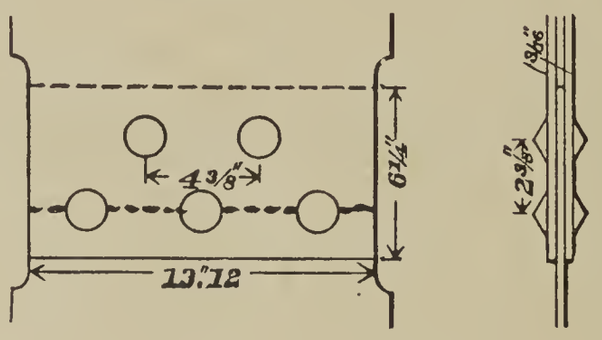
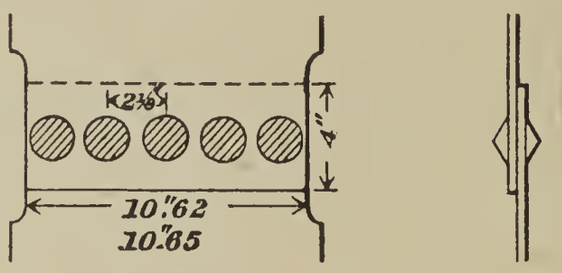
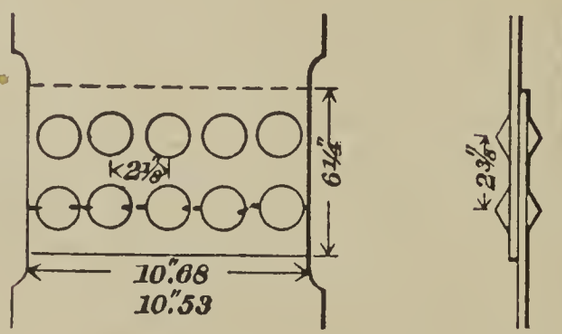
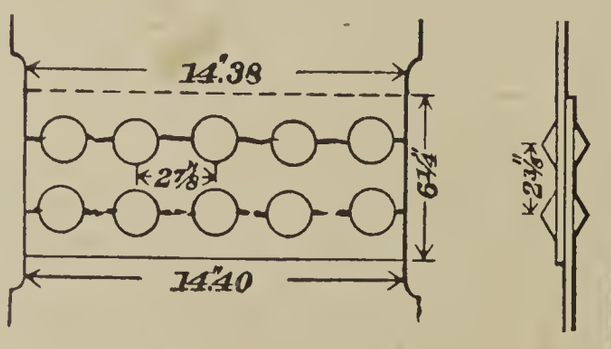
No. of test.	Sheet letters. Plate.	Covers.		Style of joint.	Nominal thickness— Plate.	Cov-ers.	Size and kind of holes.
					Inch.	*Inch.*	*Inch.*
4928	L	D	E		¼	3/16	⅞ drilled ...
4917	M	E	E		¼	3/16	⅞ drilled ...
4918	M	E	E		¼	3/16	⅞ drilled ...
4921	K	C	B		¼	3/16	⅞ drilled ...
4922	K	C	C		¼	3/16	⅞ drilled ...
4929	K	B	C		¼	3/16	⅞ drilled ...
4930	K	C	.....		¼	3/16	⅞ drilled ...
4923	J	A	A		¼	3/16	⅞ drilled....
4924	J	A	.....		¼	3/16	⅞ drilled....

¼″ PLATE.

Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.247	3.54	2.46	1.95	10.82	61,470	47,420	**68,240**	86,090	15,520	77.1
.246	3.69	2.61	1.08	6.01	58,170	46,290	65,440	**158,150**	28,420	79.6
.247	3.70	2.62	1.08	6.01	58,170	44,400	62,700	**152,110**	27,330	76.3
.252	3.16	2.27	1.76	9.62	58,150	46,330	**64,490**	83,180	15,220	79.6
.252	3.15	2.27	1.76	9.62	58,150	46,730	**64,850**	83,640	15,300	80.3
.255	3.19	2.30	1.56	8.41	58,150	46,610	**64,650**	95,320	17,680	80.2
.251	3.14	2.26	1.56	8.41	58,150	47,520	**66,020**	95,640	17,740	81.7
.257	2.97	2.30	1.35	7.21	61,000	49,520	**63,940**	108,930	20,400	81.2
.255	2.94	2.27	1.34	7.21	61,000	49,460	**64,050**	108,510	20,170	81.1

¼″ PLATE.

[Figures in heavy-faced type denote manner of failure.]

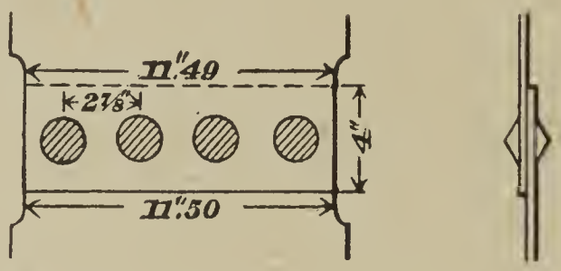
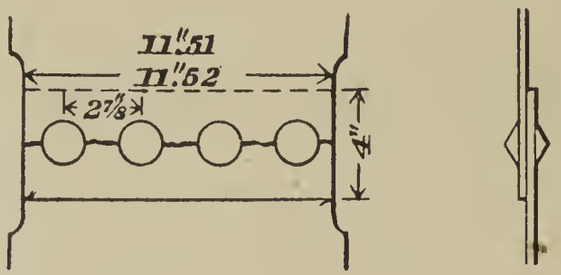
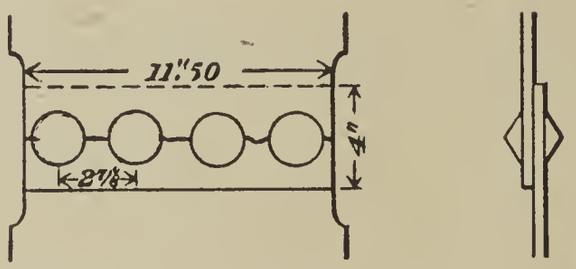
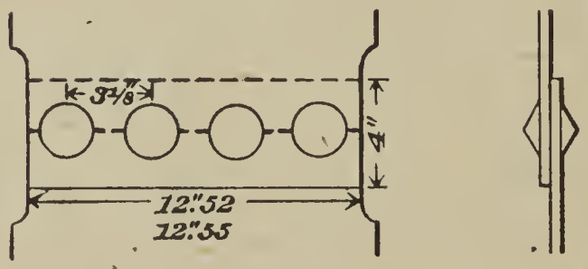
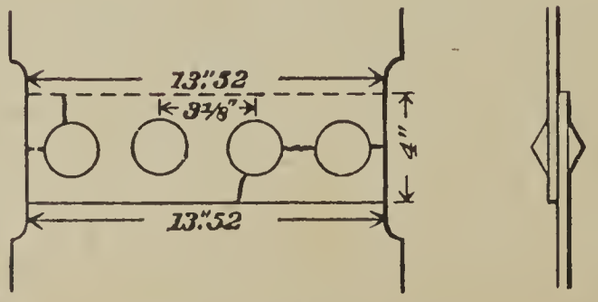
No. of test.	Sheet letters. Plate.	Covers.		Style of joint.	Nominal thickness. Plate.	Covers.	Size and kind of holes.
					Inch.	*Inch.*	*Inch.*
4925	L	B	.....		¼	3/16	⅞ drilled....
4926	K	C	B		¼	3/16	⅞ drilled....
4931	H	D	D		¼	3/16	⅞ drilled....
4932	H	C	C		¼	2/16	⅞ drilled....
4933	I—J	.....	.....		¼	.....	⅞ drilled....
4934	J—J	.....	.....		¼	.....	⅞ drilled....
4935	J—J	.....	.....		¼	.....	⅞ drilled....
4936	I—J	....	....		¼	.....	⅞ drilled....
4937	L—M	.....	.....		¼	.....	⅞ drilled....
4938	I—L	.....	.....		¼	.....	⅞ drilled....

¼″ PLATE.

Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.251	3.29	2.63	1.32	7.21	61,470	51,440	**64,350**	128,210	23,470	83.7
.230	3.01	2.41	1.21	7.21	58,150	55,500	**69,320**	138,070	23,170	95.4
.248	3.25	2.60	1.05	6.01	59,180	47,640	**59,550**	147,450	25,760	80.5
.246	3.23	2.58	1.08	6.01	59,180	46,720	**58,490**	139,720	25,110	78.9
.252	2.68	1.57	1.10	3.00	61,000	39,750	67,850	96,840	**35,510**	65.1
.253	2.70	1.59	1.11	3.00	61,000	39,660	67,360	96,490	**35,700**	65.0
.257	2.74	1.62	2.25	6.01	61,000	42,770	**72,350**	52,090	19,500	70.1
.251	2.64	1.54	2.20	6.01	62,300	42,350	**72,600**	58,180	18,600	67.9
.248	3.57	2.49	2.17	6.01	61,470	47,870	**68,630**	78,760	28,440	77.9
.249	3.58	2.49	2.18	6.01	61,470	48,530	**69,780**	79,700	28,910	78.9

¼″ PLATE

[Figures in heavy-faced type denote manner of failure.]

No. of test.	Sheet letters. Plate.	Sheet letters. Covers.	Style of joint	Nominal thickness— Plate.	Nominal thickness— Covers.	Size and kind of holes.
				Inch.	*Inch.*	*Inches.*
4939	L—K	....		¼	.....	1 drilled....
4940*	J—J	....		¼	.....	1 drilled....
4941	K—J	....		¼	.....	1⅛ drilled...
4942	K—J	....		¼	.....	1⅛ drilled...
4943	K—K	....		¼	.....	1¼ drilled...
4944	K—J	....		¼	.....	1¼ drilled...
4945	K—K	....		¼	.....	1¼ drilled...
4946	L—G	....		¼	.....	1¼ drilled...
4947†	N—H	....		¼	.....	1¼ drilled.
4948‡	N—H	....		¼	.....	1¼ drilled...

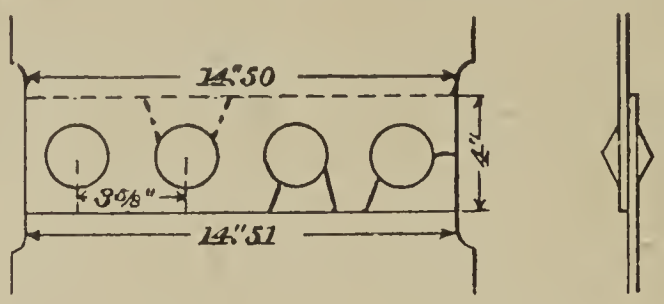
* Pulled off rivet heads. † Pulled off 3 rivet heads. ‡ Pulled off 2 rivet heads.

¼″ PLATE.

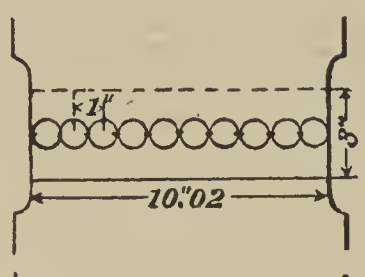
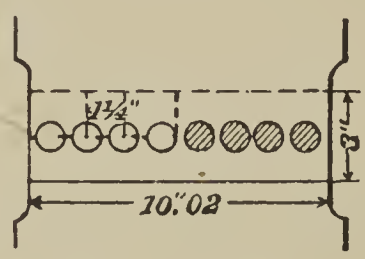
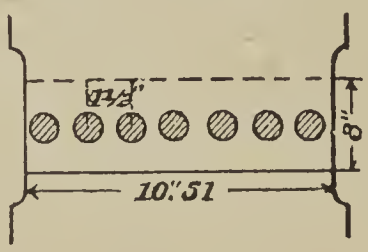
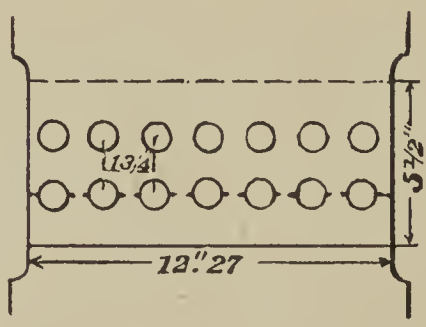
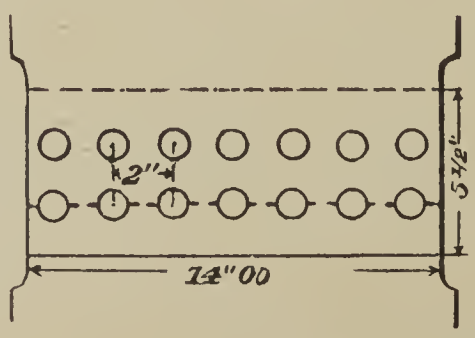
Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.250	2.87	1.87	1.00	3.14	58,150	40,560	62,250	116,400	**37,070**	69.7
.256	2.94	1.92	1.02	3.14	61,000	37,010	56,670	106,670	34,650	60.6
.252	2.90	1.77	1.13	3.98	61,000	43,280	**70,900**	111,060	31,530	70.9
.250	2.88	1.75	1.13	3.98	58,150	42,770	**73,880**	119,010	30,950	73.5
.252	2.90	1.64	1.26	4.91	58,150	41,130	**72,730**	94,660	24,290	70.7
.253	2.91	1.64	1.27	4.91	58,150	40,200	**71,330**	92,110	23,820	69.1
.248	3.10	1.86	1.24	4.91	58,150	40,030	**66,720**	100,080	25,270	69.1
.253	3.17	1.91	1.26	4.91	61,470	41,770	**69,320**	105,080	26,970	68.0
.247	3.34	2.10	1.24	4.91	55,740	42,240	67,180	**112,970**	28,730	75.7
.247	3.34	2.10	1.24	4.91	59,180	42,600	**67,760**	**114,760**	28,980	71.9

¼″ PLATE.

[Figures in heavy-faced type denote manner of failure,

No. of test.	Sheet letters. Plate.	Sheet letters. Covers.		Style of joint.	Nominal thickness— Plate.	Nominal thickness— Covers.	Size and kind of holes.
					Inch.	*Inch.*	*Inches.*
4949	M—L	.....	.....		¼	.....	1¼ drilled ..
4950*	M—L	.....	.....		¼	.....	1¼ drilled ..

5/16″ PLATE.

5125	R	A	A		5/16	3/16	½ drilled ...
5126	R	A	.....		5/16	3/16	½ drilled ...
5127	R	B	.....		5/16	3/16	½ drilled ...
5128	R	C	C		5/16	3/16	½ drilled ...
5129	Q	C	.....		5/16	3/16	½ drilled ...

* Pulled off rivet heads.

¼″ PLATE.

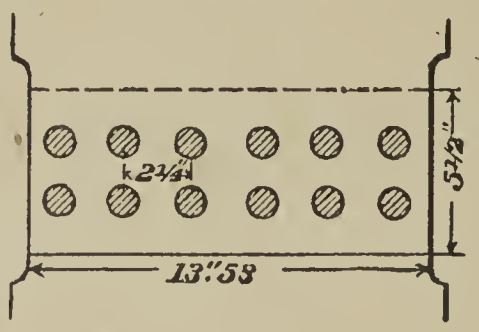
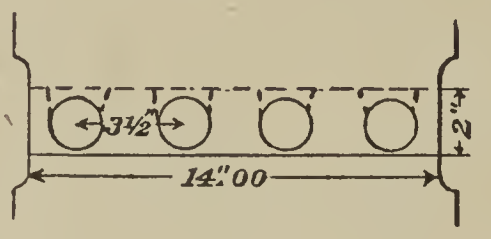
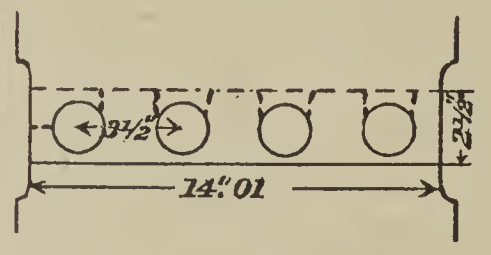
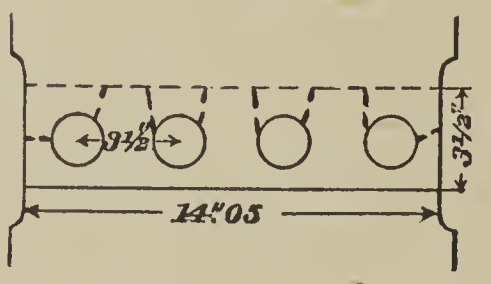
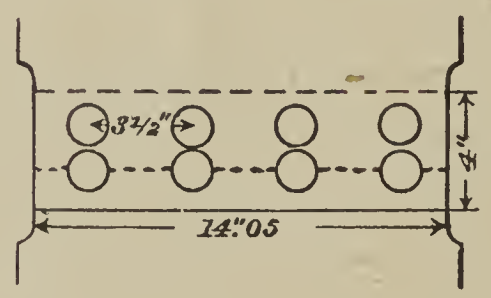
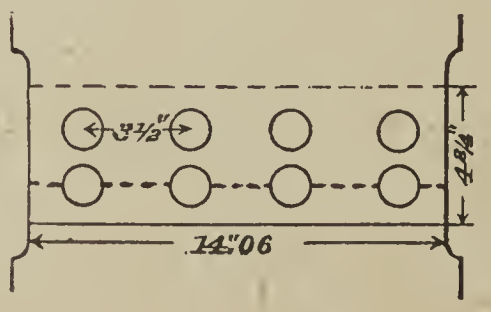
Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.248	3.60	2.36	1.24	4.91	61,470	41,390	63,140	**120,180**	30,350	67.3
.247	3.58	2.35	1.23	4.91	58,170	42,150	64,210	122,680	30,730	72.4

$\frac{5}{16}$″ PLATE.

.306	3.07	1.54	1.53	3.92	61,130	35,930	**71,620**	72,090	28,140	58.8
.304	3.05	1.83	1.22	3.14	61,130	41,280	**68,800**	103,200	**40,100**	67.5
.310	3.26	2.17	1.09	2.74	61,130	39,250	58,960	117,380	**46,690**	64.2
.304	3.73	2.66	2.13	5.49	61,130	46,690	**66,650**	83,240	32,300	76.4
.305	4.27	3.20	2.14	5.49	56,760	49,040	**65,430**	97,850	38,140	86.4

$\frac{5}{16}$" PLATE.

[Figures in heavy-faced type denote manner of failure.]

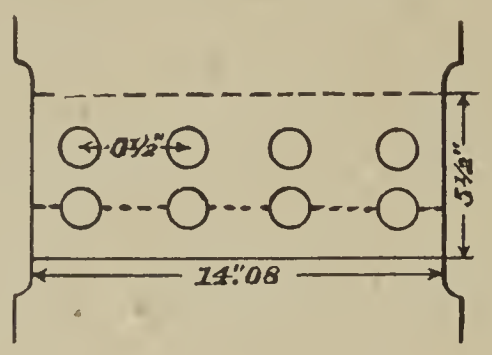
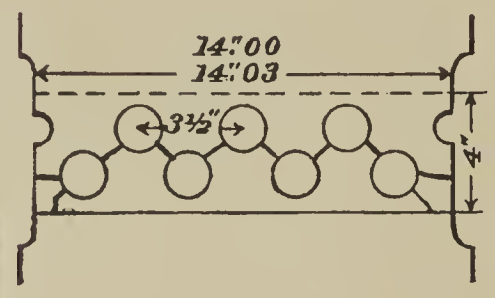
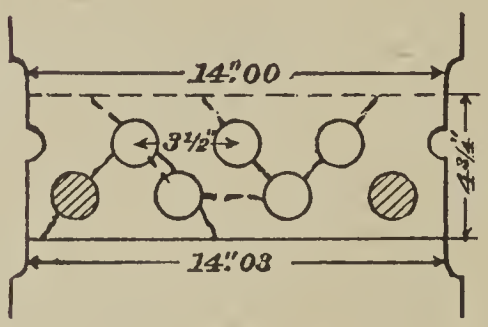
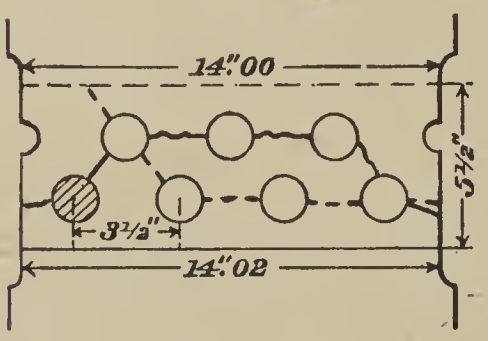
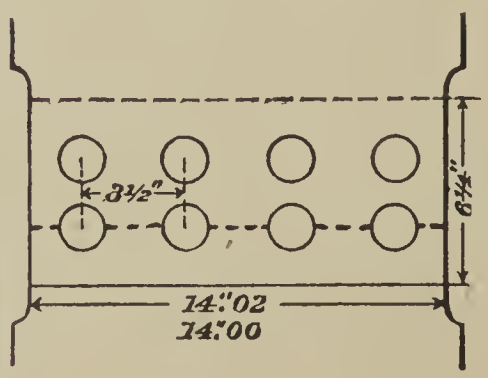
No. of test.	Sheet letters. Plate.	Sheet letters. Covers.		Style of joint.	Nominal thickness— Plate.	Nominal thickness— Covers.	Size and kind of holes.
					Inch.	*Inch.*	*Inch.*
5130	S	D	.....		$\frac{5}{16}$	$\frac{3}{16}$	$\frac{1}{2}$ drilled ...
4985	Q	D	D		$\frac{5}{16}$	$\frac{3}{16}$	1 drilled ...
4987	S	C	.....		$\frac{5}{16}$	$\frac{3}{16}$	1 drilled ...
4991	Q	E	.....		$\frac{5}{16}$	$\frac{3}{16}$	1 drilled ...
4993	Q	E	.....		$\frac{5}{16}$	$\frac{3}{16}$	1 drilled ...
4995	Q	E	.....		$\frac{5}{16}$	$\frac{3}{16}$	1 drilled ...

$\frac{5}{16}$″ PLATE.

Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.307	4.15	3.23	1.84	4.70	57,000	46,480	59,720	104,840	**41,040**	81.5
.309	4.33	3.09	1.24	6.28	56,760	24,040	33,690	**83,950**	16,580	42.3
.310	4.34	3.10	1.24	6.28	57,000	26,770	37,480	**93,710**	18,500	46.9
.308	4.33	3.10	1.23	6.28	56,760	33,940	47,410	**119,500**	23,400	59.8
.309	4.34	3.11	2.47	12.57	56,760	44,740	**62,430**	78,600	15,450	78.8
.305	4.29	3.07	2.44	12.57	56,760	45,490	**63,570**	79,980	15,530	80.1

$\frac{5}{16}$" PLATE.

[Figures in heavy-faced type denote manner of failure.]

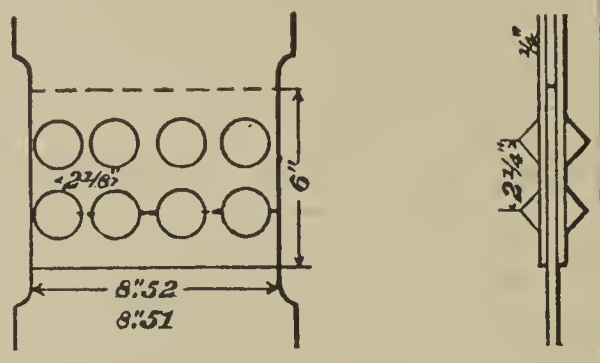
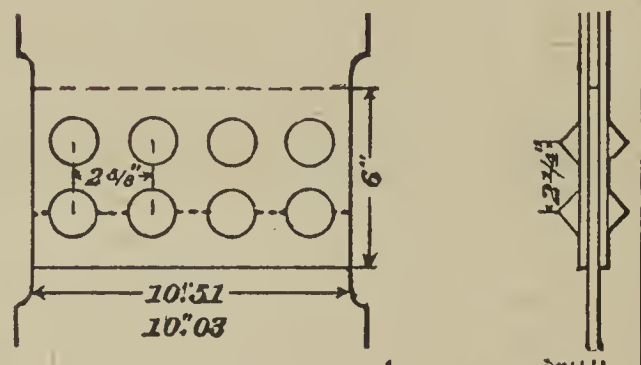
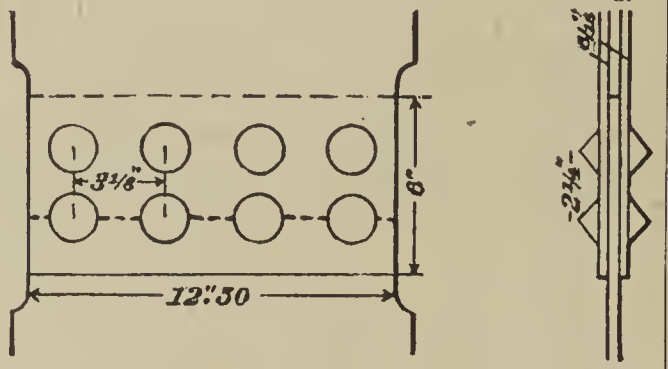
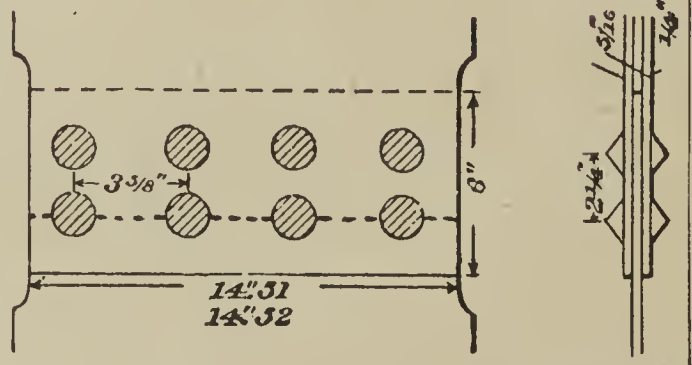
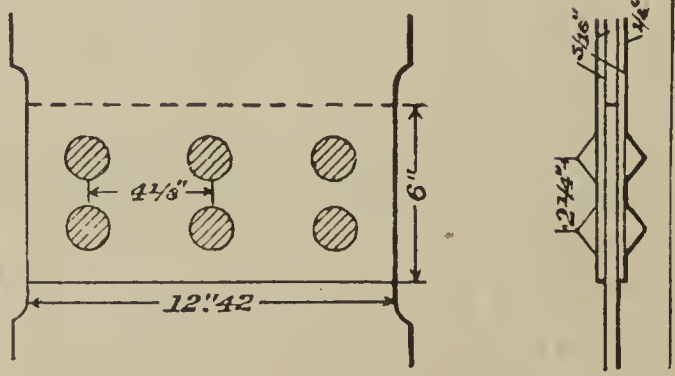
No. of test.	Sheet letters. Plate.	Covers.		Style of joint.	Nominal thickness— Plate.	Covers.	Size and kind of holes.
					Inch.	*Inch.*	*Inch.*
4997	Q	E	.....		$\frac{15}{16}$	$\frac{3}{16}$	1 drilled ...
5119	O—Q	.....	.....		$\frac{5}{16}$	.....	1 drilled ...
5120	P—P	.....	.....		$\frac{5}{16}$	.....	1 punched..
5121	Q—O	.....	.....		$\frac{5}{16}$	.....	1 drilled ...
5122	O—O	.....	.....		$\frac{5}{16}$	.....	1 punched..
5123	O—O	.....	.....		$\frac{5}{16}$	.....	1 drilled ...
5124	P—P	.....	.....		$\frac{5}{16}$	.....	1 punched..
4999	Q—Q	.....	.....		$\frac{5}{16}$	.....	1 drilled ...
5000	P—P	.....	.....		$\frac{5}{16}$	.....	1 punched..

$\frac{5}{16}$″ PLATE.

Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Percent.*
.308	4.34	3.10	2.46	12.57	56,760	45,530	**63,740**	80,330	15,720	80.2
.303	4.24	3.03	2.12	5.50	56,760	42,750	**59,830**	85,510	32,960	75.3
.305	4.28	3.02	2.20	5.50	59,300	40,630	**57,580**	79,050	31,620	68.5
.302	4.23	3.02	2.11	5.50	54,350	42,990	60,220	**86,180**	33,060	79.1
.304	4.27	3.01	2.19	5.50	54.350	44,340	62,900	**86,450**	34,420	81.6
.302	4.23	3.02	2.11	5.50	54,350	44,870	**62,850**	89,950	34,510	82.5
.307	4.33	3.03	2.22	5.50	59,300	43,490	**62,150**	84,820	31,400	73.3
.305	4.28	3.06	2.44	6.28	56,760	46,070	**64,440**	80,820	31,400	80.1
.306	4.28	3.03	2.53	6.28	59,300	43,960	**62,100**	74,370	29,960	74.1

$\frac{3}{8}$″ PLATE.

[Figures in heavy-faced type denote manner of failure.]

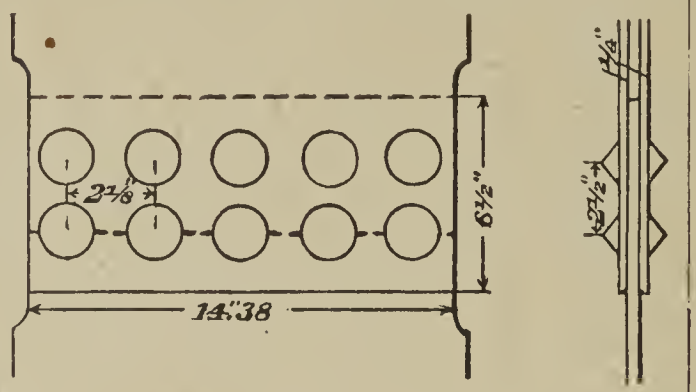
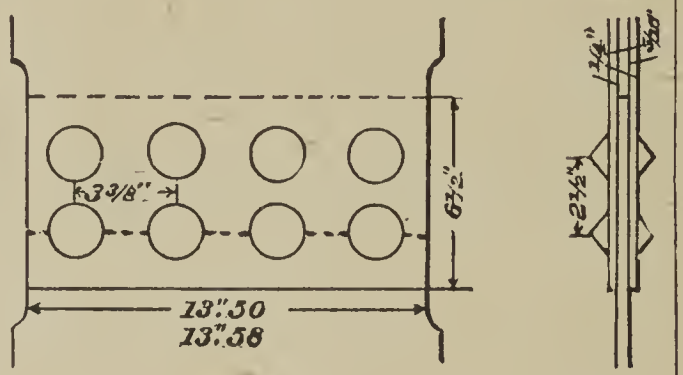
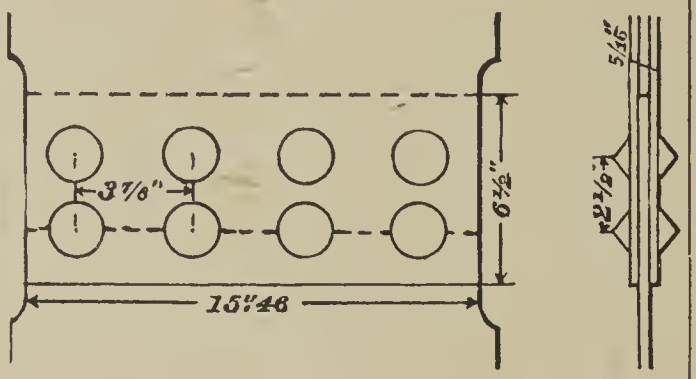
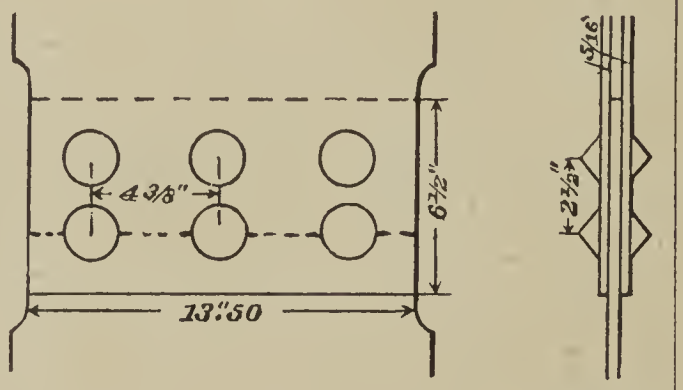
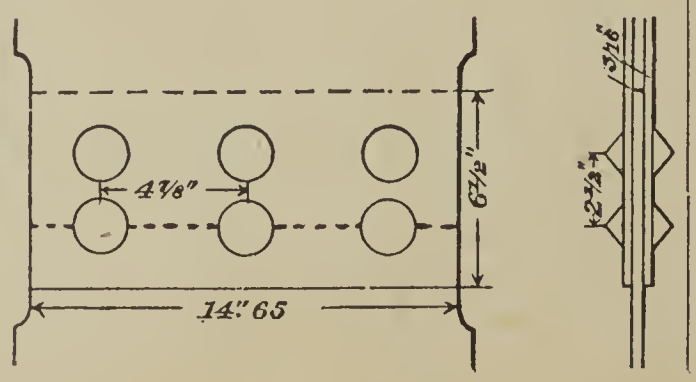
No. of test.	Sheet letters. Plate.	Sheet letters. Covers.		Style of joint.	Nominal thickness— Plate.	Nominal thickness— Covers.	Size and kind of holes.
					Inch.	*Inch.*	*Inch.*
4951	B	I	I		$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{4}$ drilled....
4952	E	R	.....		$\frac{3}{8}$	$\frac{5}{16}$	$\frac{3}{4}$ drilled....
4953	E	R	.....		$\frac{3}{8}$	$\frac{5}{16}$	$\frac{3}{4}$ drilled....
4954	E	N	H		$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{4}$ drilled....
4955	E	S	.....		$\frac{3}{8}$	$\frac{5}{16}$	$\frac{3}{4}$ drilled....
4957	H	O	O		$\frac{3}{8}$	$\frac{5}{16}$	$\frac{3}{4}$ drilled....
4958	H	M	M		$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{4}$ drilled....
4959	B	S	S		$\frac{3}{8}$	$\frac{5}{16}$	$\frac{3}{4}$ drilled....
4960	E	L	N		$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{4}$ drilled....

$\frac{3}{8}$″ PLATE.

Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress of joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.392	3.34	2.16	2.35	7.07	59,730	43,290	**66,940**	61,520	20,450	72.4
.383	3.26	2.11	2.30	7.07	58,340	42,380	**65,470**	60,070	19,540	72.6
.388	4.08	2.91	2.33	7.07	58,340	46,590	**65,330**	81,590	26,890	79.8
.384	3.85	2.70	2.30	7.07	58,340	49,130	**70,060**	82,240	26,750	84.2
.383	4.79	3.64	2.30	7.07	58,340	48,610	**63,970**	101,250	32,940	83.3
.369	5.35	4.25	2.21	7.07	56,670	48,500	**61,060**	117,420	36,700	85.5
.369	5.36	4.25	2.21	7.07	56,670	47,700	60,160	115,700	**36,170**	84.1
.388	4.82	3.95	1.75	5.30	59,730	43,070	52,560	118,630	**39,170**	72.1
.384	4.77	3.91	1.73	5.30	58,340	42,520	51,870	117,230	**38,260**	72.8

$\frac{3}{8}$″ PLATE.

[Figures in heavy-faced type denote manner of failure.]

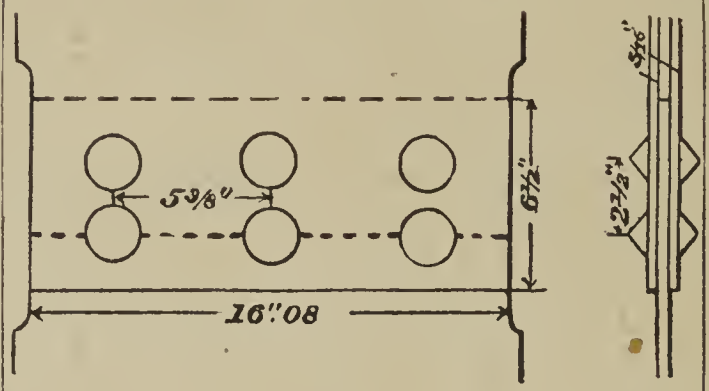
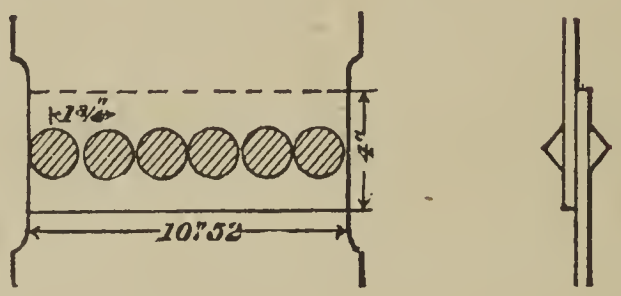
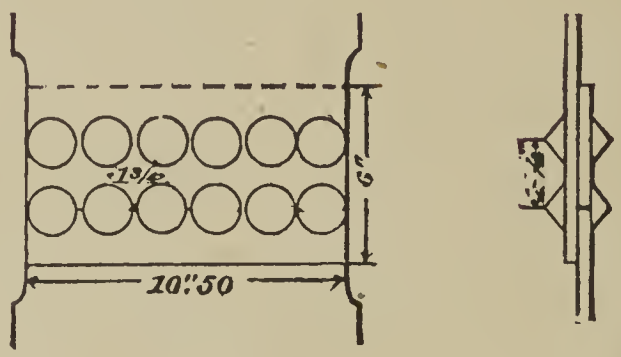
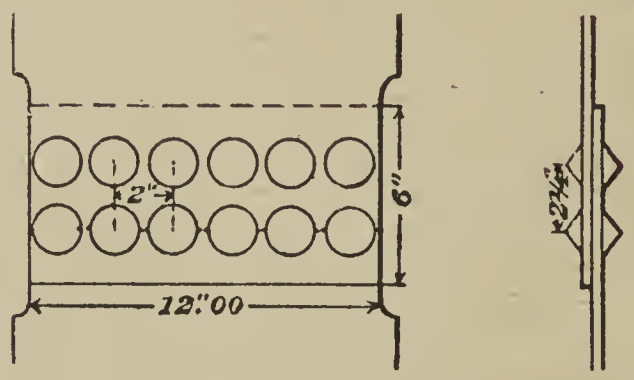
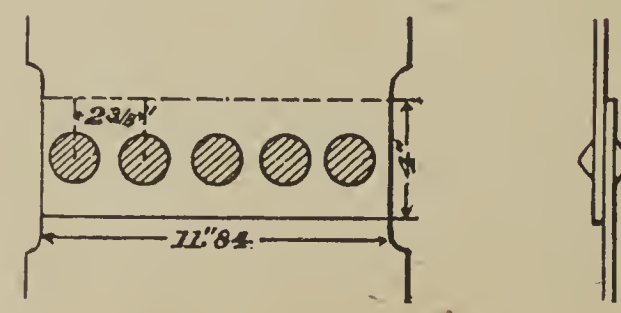
No. of test.	Sheet letters. Plate.	Covers.		Style of joint.	Nominal thickness— Plate.	Cov-ers.	Size and kind of holes.
					Inch.	*Inch.*	*Inch.*
4967	C	M	M		$\frac{3}{8}$	$\frac{1}{4}$	1 drilled....
4969	E	M	.....		$\frac{3}{8}$	$\frac{1}{4}$	1 drilled....
4970	F	.....	.....		$\frac{3}{8}$	$\frac{5}{16}$	1 drilled....
4971	J	P	P		$\frac{3}{8}$	$\frac{5}{16}$	1 drilled....
4973	E	S	S		$\frac{3}{8}$	$\frac{5}{16}$	1 drilled....
4975	I	O	P		$\frac{3}{8}$	$\frac{5}{16}$	1 drilled....

$\frac{3}{8}$″ PLATE.

Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.375	5.39	3.52	3.75	15.71	57,870	42,890	**65,680**	61,650	14,720	74.1
.382	5.16	3.63	3.06	12.57	58,340	44,260	**62,920**	74,640	18,170	75.9
.380	5.16	3.64	3.04	12.57	54,290	43,240	**61,290**	73,390	17,750	79.6
.379	5.86	4.34	3.03	12.57	57,130	44,910	**60,650**	86,860	20,940	78.6
.385	5.20	4.04	2.31	9.42	58,340	45,980	**59,180**	103,510	25,380	78.8
.373	5.46	4.35	2.24	9.42	59,030	46,720	**58,640**	113,880	27,080	79.1

⅜″ PLATE.

[Figures in heavy-faced type denote manner of failure.]

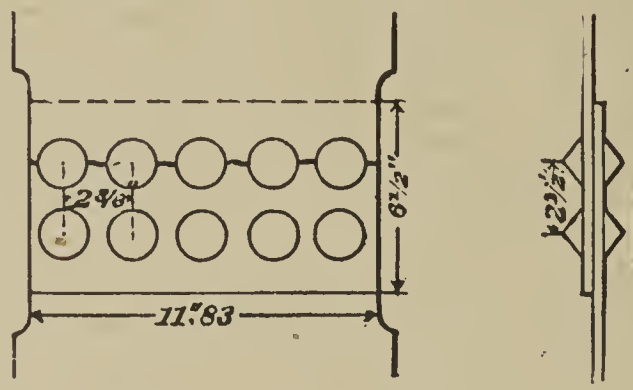
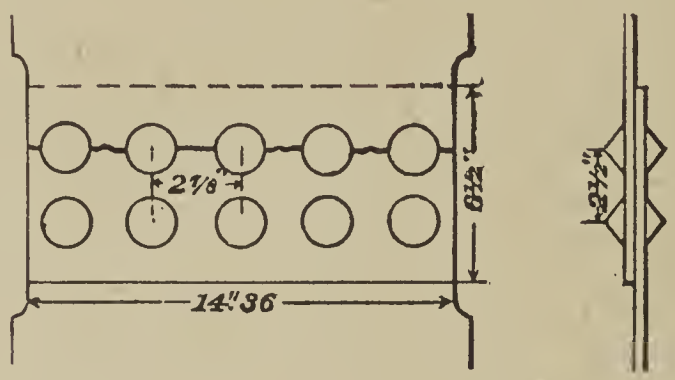
No. of test.	Sheet letters.— Plate.	Sheet letters.— Covers.		Style of joint.	Nominal thickness— Plate.	Nominal thickness— Covers.	Size and kind of holes.
					Inch.	*Inch.*	*Inch.*
4977	J	P	P		⅜	5/16	1 drilled....
4961	B—E	.....	.....		⅜	.....	¾ drilled....
4963	E—E	.....	.....		⅜	.....	¾ drilled....
4965	E—E	.....	.....		⅜	.....	¾ drilled ...
4979	E—E	.....	.....		⅜	.....	1 drilled ...

⅜″ PLATE.

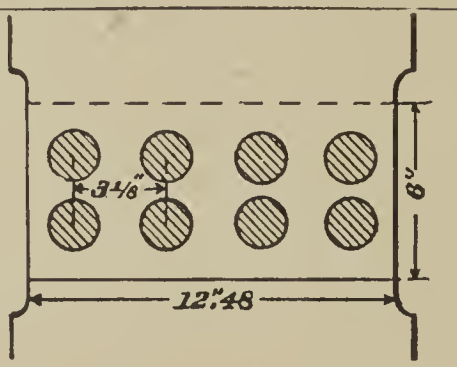
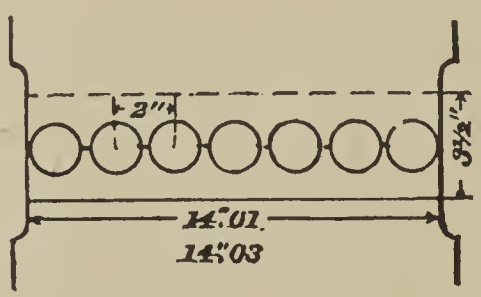
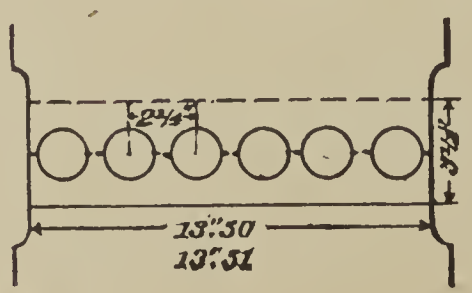
Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.379	6.09	4.96	2.27	3.42	57,130	44,650	**54,830**	119,800	28,870	78.1
.388	4.08	2.33	1.75	2.65	58,340	25,950	45,440	60,500	**39,950**	44.4
.387	4.06	2.32	3.48	5.30	58,340	40,570	**70,990**	47,330	31,080	69.5
.384	4.61	2.88	3.46	5.30	58,340	42,150	**67,470**	56,160	36,660	72.2
.384	4.55	2.63	1.92	3.93	58,340	33,050	57,190	78,330	**38,270**	56.6

3/8" PLATE.

[Figures in heavy-faced tpye denote manner of failure.]

No. of test.	Sheet letters. Plate.	Sheet letters. Covers.		Style of joint.	Nominal thickness— Plate.	Nominal thickness— Covers.	Size and kind of holes.
					Inch.	*Inch.*	*Inch.*
4981	E—D	.....	.....		⅜	.....	1 drilled ...
4983	D—H	.....	.....		⅜	.....	1 drilled ...

7/16 PLATE.

4956	K	N	N		7/16	¼	¾ drilled ...
5144	L	O	O		7/16	5/16	⅞ drilled ...
5143	L	P	.....		7/16	5/16	⅞ punched .
5145	O	Q	Q		7/16	5/16	⅞ drilled ...
5146	M	O	.....		7/16	5/16	⅞ punched .

$\frac{5}{8}$″ PLATE.

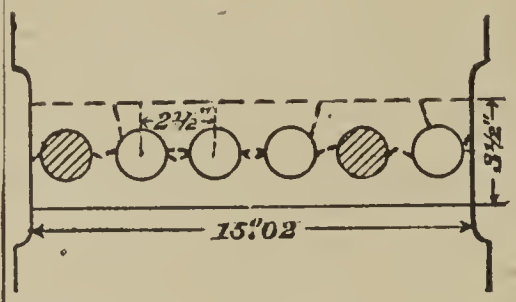
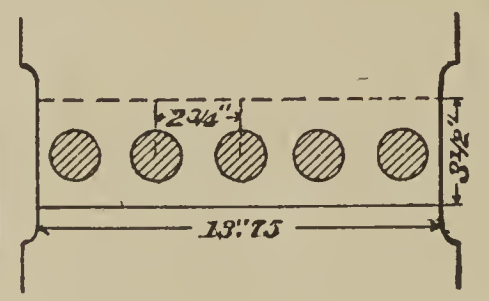
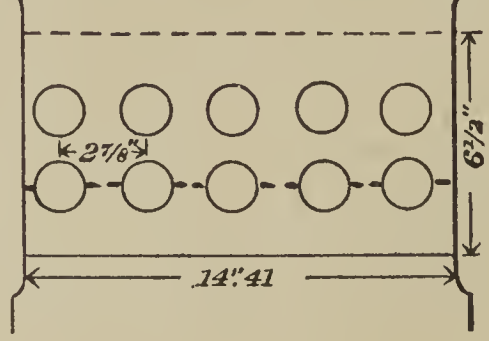
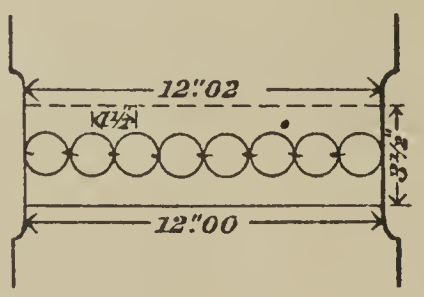
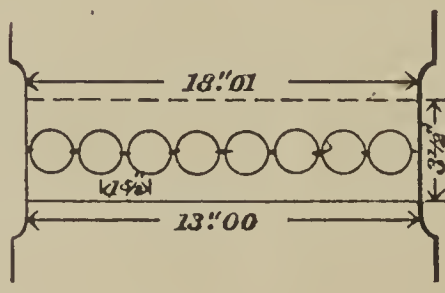
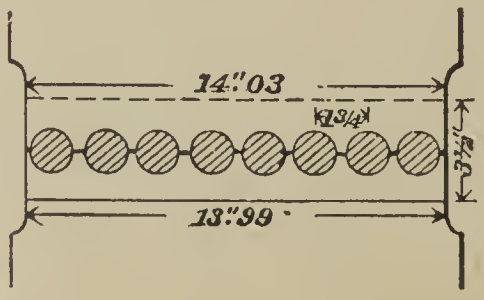
Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.385	4.55	2.63	3.85	7.85	53,730	38,790	**67,100**	45,840	22,480	72.2
.370	5.31	3.46	3.70	7.85	56,670	43,050	**66,070**	61,780	29,120	76.0

$\frac{7}{16}$ PLATE.

.427	5.33	4.05	2.56	7.07	59,000	48,120	63,300	100,190	**36,280**	83.3
.440	6.16	3.48	2.69	8.41	59,390	23,360	**41,350**	53,490	17,110	39.3
.440	6.17	3.38	2.79	8.41	59,390	32,540	**59,410**	71,970	23,880	54.8
.434	5.86	3.58	2.28	7.21	52,910	42,250	**63,160**	108,600	34,340	79.8
.421	5.69	3.40	2.29	7.21	61,650	39,740	**66,500**	98,730	31,360	64.5

7/16" PLATE.

[Figures in heavy-faced type denote manner of failure.]

No. of test.	Sheet letters. Plate.	Sheet letters. Covers.		Style of joint.	Nominal thickness— Plate.	Nominal thickness— Covers.	Size and kind of holes.
					Inch.	*Inch.*	*Inch.*
5147	O	P	P		7/16	5/16	7/8 drilled ...
5148	N	P	.....		7/16	5/16	7/8 punched .
5155	K	S	.....		7/16	5/16	7/8 drilled ...
4968	N	O	.....		7/16	5/16	1 drilled ...
5131	K—K	.....	.....		7/16	.....	7/8 drilled ...
5132	N—O	.....	.....		7/16	.....	7/8 punched .
5133*	K—K	.....	.....		7/16	.....	7/8 drilled ...
5134	N—N	.....	.....		7/16	.....	7/8 punched .
5135	M—M	.....	.....		7/16	.....	7/8 drilled ...
5136	.....	.....	.....		7/16	.....	7/8 punched .

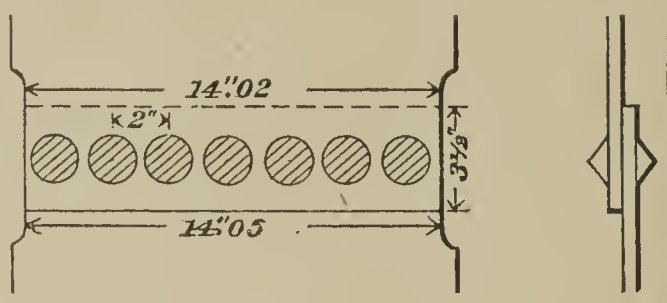
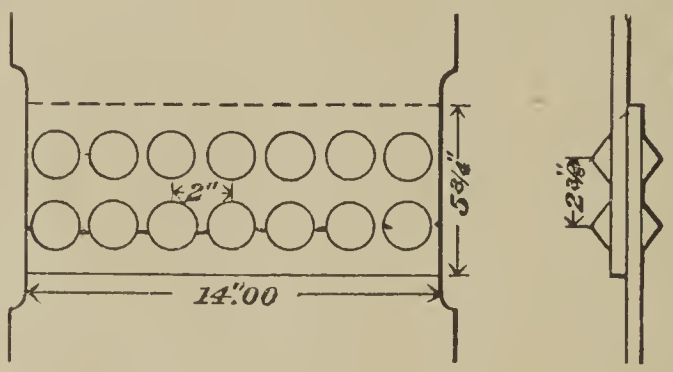
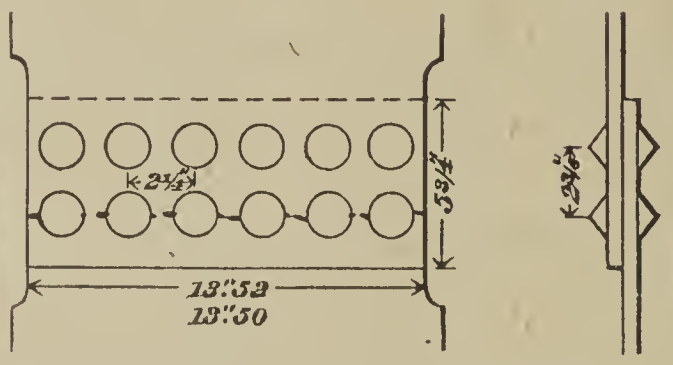
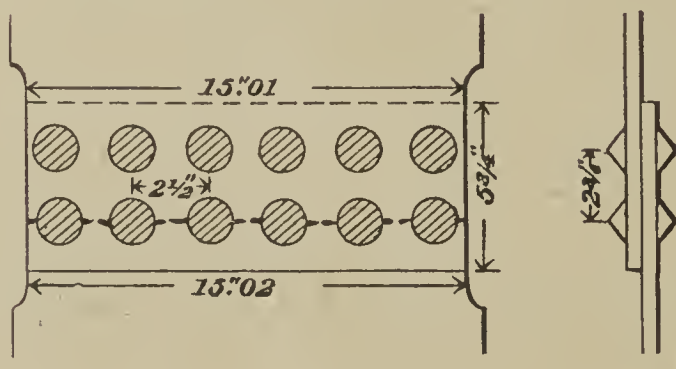
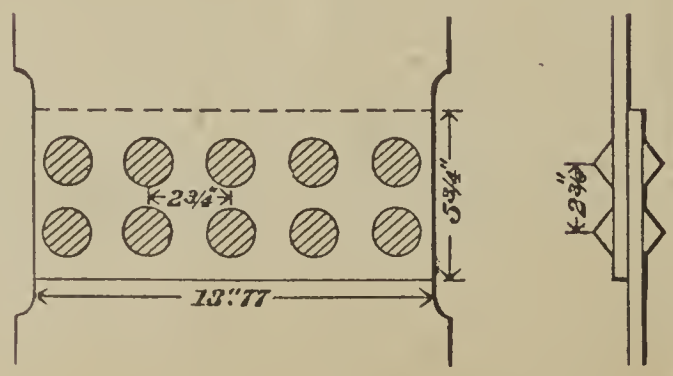
$\frac{7}{16}$" PLATE.

Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Percent.*
.413	6.20	4.03	2.17	7.21	52,910	44,150	**67,920**	126,130	37,960	83.4
.411	6.17	3.94	2.23	7,21	61,650	36,660	**57,410**	101,430	31,370	60.0
.425	5.84	3.98	1.86	6.01	59,000	40,270	59,100	126,450	**39,130**	68.3
.409	5.89	3.85	4.09	15.71	61,140	43,360	**66,340**	62,440	16,260	70.9
.427	5.12	2.13	2.99	4.81	59,000	31,740	**76,290**	54,350	33,780	53.8
.415	4.99	1.98	3.01	4.81	52,910	27,820	**70,100**	46,110	28,860	52.6
.427	5.55	2.56	2.99	4.81	59,000	31,100	67,420	57,730	35,880	*52.7
.413	5.37	2.37	2.99	4.81	61,140	30,370	**68,820**	54,550	33,910	49.7
.422	5.90	2.95	2.95	4.81	61,650	29,240	58,490	58,490	**35,870**	47.4
.420	5.89	2.95	2.94	4.81	.....	31,870	**63,630**	63,840	39,020	.....

*Pulled off rivet heads.

$\frac{7}{16}$″ PLATE.

[Figures in heavy-faced type denote manner of failure.]

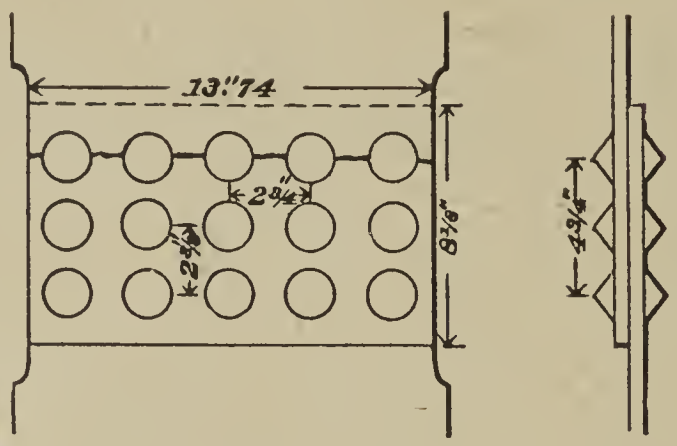
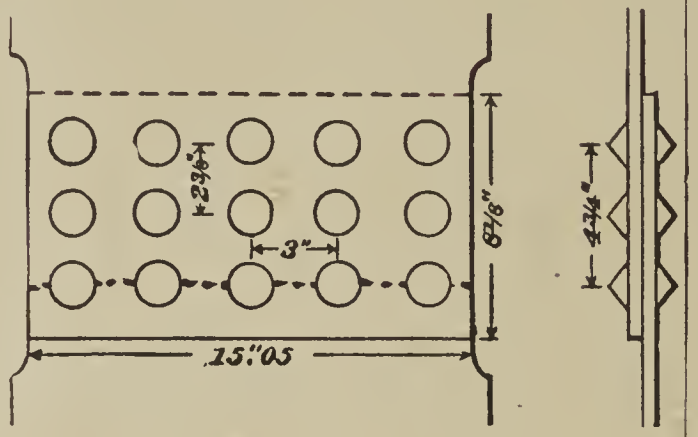
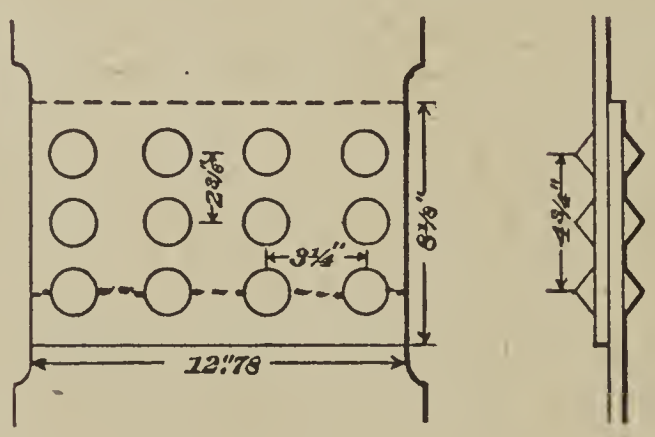
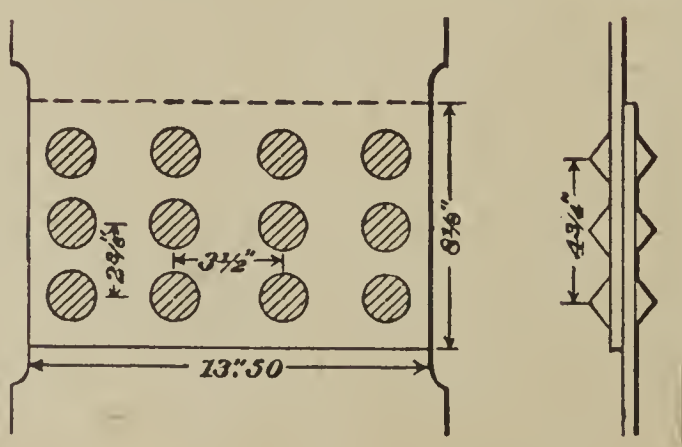
No. of test.	Sheet letters. Plate.	Sheet letters. Covers.	Style of joint.	Nominal thickness— Plate.	Nominal thickness— Covers.	Size and kind of holes.
				Inch.	*Inch.*	*Inch.*
5137	L—M	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ drilled ...
5138	O—M	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ punched .
5149	M—L	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ drilled ...
5150	M—M	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ punched .
5151	K—K	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ drilled ...
5152	L—O	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ punched .
5153	O—O	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ drilled ...
5154	O—O	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ punched .
5156	K—K	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ drilled ...

$\frac{7}{16}$″ PLATE.

Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.424	5.94	3.35	2.60	4.21	59,390	27,580	48,900	63,000	**38,910**	46.4
.420	5.90	3.24	2.66	4.21	52,910	28,530	51,940	63,270	**39,980**	53.9
.425	5.95	3.35	5.21	8.41	61,650	40,620	**72,150**	46,390	28,740	65.8
.423	5.93	3.24	5.36	8.41	61,650	37,910	**69,380**	41,940	26,730	61.4
.428	5.79	3.54	4.49	7.21	59,000	43,150	**70,570**	55,640	34,650	73.1
.440	5.94	3.55	4.78	7.21	59,390	38,870	**65,040**	48,310	32,020	65.4
.409	6.14	3.99	4.29	7.21	52,910	43,530	66,990	62,310	**37,070**	82.3
.412	6.19	3.95	4.48	7.21	52,910	40,380	**63,290**	55,800	34,670	76.3
.422	5.81	3.96	3.69	6.01	59,000	38,850	56,990	61,170	**37,550**	65.8

$\frac{7}{16}$" PLATE.

[Figures in heavy-faced type denote manner of failure.]

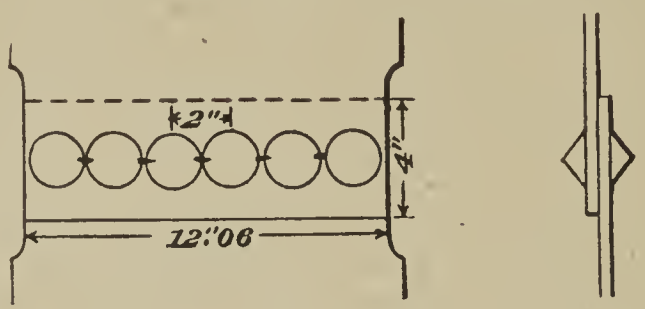
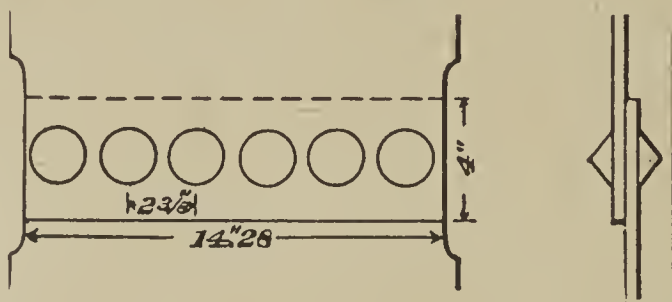
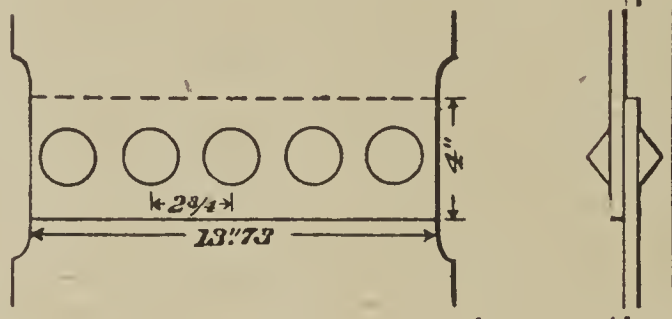
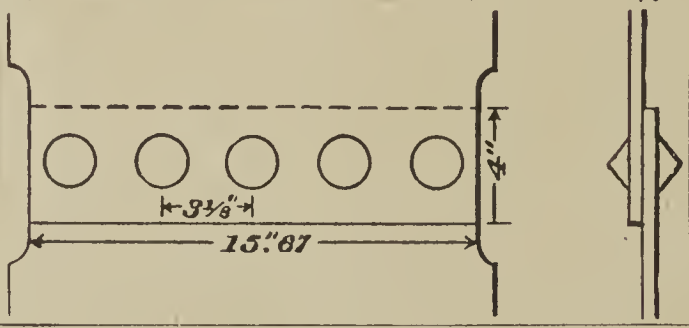
No. of test.	Sheet letters. Plate.	Sheet letters. Covers.	Style of joint.	Nominal thickness— Plate.	Nominal thickness— Covers.	Size and kind of holes.
				Inch.	*Inch.*	*Inch.*
5157	K--K	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ drilled ...
5158	O--P	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ drilled ...
5159	P—P	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ drilled ...
5160	L—L	....		$\frac{7}{16}$	.....	$\frac{7}{8}$ drilled ...

$\frac{7}{8}$" PLATE.

Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.432	5.93	4.04	5.66	9.02	59,000	45,720	**67,100**	47,900	30,060	77.5
.412	6.20	4.40	5.41	9.02	52,910	48,710	**68,630**	55,820	33,480	92.1
.432	5.52	4.01	4.54	7.21	58,090	48,040	**66,130**	58,410	36,780	82.7
.438	5.91	4.38	4.60	7.21	59,390	46,430	62,650	59,650	**38,060**	78.2

$\frac{7}{16}$" PLATE.

[Figures in heavy-faced type denote manner of failure.]

No. of test.	Sheet letters. Plate.	Sheet letters. Covers.	Style of joint.	Nominal thickness— Plate.	Nominal thickness— Covers.	Size and kind of holes.
				Inch.	*Inch.*	*Inch.*
5139	P—K	....		$\frac{7}{16}$	.....	1¼ drilled ..
*5140	M—M	....		$\frac{7}{16}$	.....	1¼ drilled ..
*5141	L—L	....		$\frac{7}{16}$	.....	1¼ drilled ..
*5142	Q—Q	....		$\frac{7}{16}$	.....	1¼ drilled ..

* Pulled off rivet heads.

$\frac{7}{16}$″ PLATE.

Actual thickness of plate.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint; pounds per square inch.				Efficiency of joint.
	Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
Inch.	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*					*Per cent.*
.428	5.16	1.95	3.21	7.36	58,090	28,190	74,610	45,320	19,770	48.5
.421	6.01	2.85	3.16	7.36	61,650	34,850	73,490	66,280	28,460	56.5
.438	6.01	3.28	2.74	6.14	59,390	33,560	61,490	73,610	32,850	56.5
.422	6.61	3.97	2.64	6.14	56,960	30,420	50,650	76,170	32,750	53.4

RETESTS BY TENSION AND COMPRESSION OF SPECIMENS FROM WROUGHT-IRON BAR NO. 601.

[See Report of Tests, 1882, page 195, for original test.]

Two tension and three compression specimens were taken from the fractured end of wrought-iron bar No. 601, 8 years and 8 months after the original test was made.

The original test gave the elastic limit 30,938 pounds per square inch, tensile strength 53,062 pounds per square inch.

The present tests were made for the purpose of determining the effect of a long period of rest following overstraining of the metal.

Since in the original test the metal stretched 21 per cent, the maximum stress per square inch, referred to the sectional area as it existed at the time the maximun load was reached, was approximately 64,200 pounds per square inch.

In tension test No. 5110, no appreciable set was caused by 65,000 pounds per square inch, and after 70,000 pounds per square inch had been applied ″.0012 set was observed in a length of 10.″ The metal stretched rapidly under 72,860 pounds per square inch, and showed a tensile strength of 74,420 pounds per square inch.

Test No. 5111, showed a similar behavior, it apparently had an elastic limit of 71,000 pounds per square inch, and had elongated under stress ″.31 at 72,000 pounds per square inch, when the test was discontinued. The specimen was cut off at the ends, reducing its length to 12″, and then tested by compression.

Sets appeared after a load of 15,000 pounds per square inch, and were increased by higher stresses.

After loading with 60,000 pounds per square inch compression, the test was again discontinued, the specimen turned down to a tensile form and the test then resumed under tensile stresses.

A set appeared after 30,000 pounds per square inch, and with 40,000 pounds per square inch and higher loads they continued to increase.

Compression specimen No. 5116 began to display sets at 20,000 pounds per square inch, which increased with higher loads. This specimen was turned down and finally ruptured by tension.

When the stresses were reversed, sets appeared at 20,000 pounds per square inch tension.

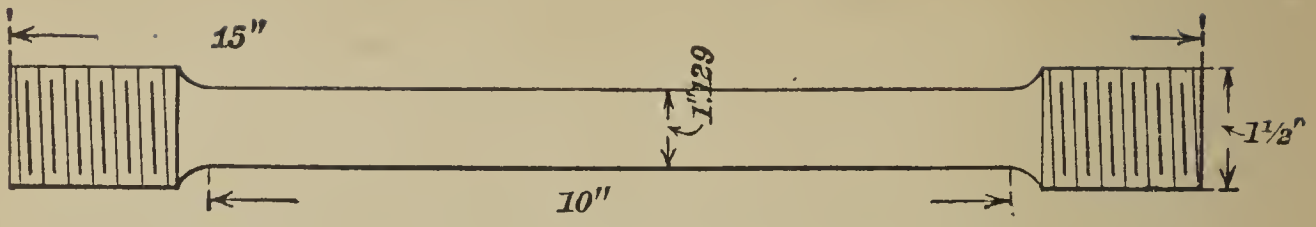
The early appearance of tensile sets is attributed to the overcompression it had just before received, for in specimen No. 5110, tested by tension without the prior overcompression, sets did not appear at 65,000 pounds per square inch stress.

In the second compression specimen sets appeared at 20,000 pounds per square inch.

The third compression specimen was annealed at 1015° Fahr. This did not appear to materially change the early sets, although at 55,000 pounds per square inch a larger set was observed than before.

From these results it appears that this overstrained tensile metal possessed an exalted tensile elastic limit, and retains but little ductility as shown by final elongation and contraction of area, and that while this rigidity of form pertains when tested by compression, yet it does not possess an equality of elastic limits in tension and compression after this prolonged period of rest.

TENSION SPECIMENS.



No. 5110.

TENSION TEST.

Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch,*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0016	0.	
10,000	10,000	.0033	.....	
15,000	15,000	.0052	0.	
20,000	20,000	.0070	.....	
25,000	25,000	.0089	.....	
30,000	30,000	.0108	0.	
35,000	35,000	.0125	.....	
40,000	40,000	.0145	—.0001	
45,000	45,000	.0164	.....	
50,000	50,000	.0182	.....	
45,000	45,000	.0164	.....	
40,000	40,000	.0145	.....	
35,000	35,000	.0127	.....	
30,000	30,000	.0108	.....	
25,000	25,000	.0090	.....	
20,000	20,000	.0070	.....	
15,000	15,000	.0051	.....	
10,000	10,000	.0032	.....	
5,000	5,000	.0014	—.0001	
50,000	50,000	.0181	.....	
51,000	51,000	.0184	.....	
52,000	52,000	.0189	.....	
53,000	53,000	.0194	.....	
54,000	54,000	.0196	.....	
55,000	55,000	.0200	.....	
56,000	56,000	.0204	.....	
57,000	57,000	.0208	.....	
58,000	58,000	.0211	.....	
59,000	59,000	.0216	.....	
60,000	60,000	.0221	—.001	
61,000	61,000	.0225	.....	
62,000	62,000	.0228	.....	
63,000	63,000	.0232	.....	
64,000	64,000	.0236	.....	
65,000	65,000	.0241	0.	
66,000	66,000	.0248	.....	
67,000	67,000	.0253	.....	
68,000	68,000	.0259	.....	
69,000	69,000	.0266	.....	
70,000	70,000	.0275	.0012	
72,860	72,860	.22	.....	Rapid stretching.
73,000	73,000	.36	.....	
73,700	73,700	.50	.....	
74,000	74,000	.57	.....	Opens cracks along surface of stem.
74,420	74,420	.67	.....	Tensile strength.
69,600	.....	.....	.....	At time of rupture.
0	0	.83	.....	=8.3 per cent.

Elongation of inch sections: ″.03, ″.07, ″.06, ″.07, ″.08, ″.20,* ″.15, ″.07, ″.07, ″.03.
Diameter at fracture, 1″.01; area, .801 square inch.
Contraction of area, 19.9 per cent.
Fractured 4″.4 from the neck. Appearance, granular.

No. 5111.

Tension Test.

Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0013	.....	
10,000	10,000	.0032	.....	
15,000	15,000	.0050	.....	
20,000	20,000	.0067	.....	
25,000	25,000	.0085	.....	
30,000	30,000	.0105	.....	
35,000	35,000	.0124	.....	
40,000	40,000	.0143	.....	
45,000	45,000	.0161	.....	
50,000	50,000	.0180	.....	
45,000	45,000	.0161	.....	
40,000	40,000	.0144	.....	
35,000	35,000	.0125	.....	
30,000	30,000	.0107	.....	
25,000	25,000	.0088	.....	
20,000	20,000	.0068	.....	
15,000	15,000	.0050	.....	
10,000	10,000	.0030	.....	
5,000	5,000	.0012	—.0003	
50,000	50,000	.0180	.....	
60,000	60,000	.0220	.....	
65,000	65,000	.0245	.....	
66,000	66,000	.0250	.....	
67,000	67,000	.0255	.....	
68,000	68,000	.0263	.....	
69,000	69,000	.0265	.....	
70,000	70,000	.0275	.....	
71,000	71,000	.0280	.....	Elastic limit. Snapping sounds.
72,000	72,000	.31	.....	

Tensile test discontinued.

Ends cut off, reducing the length to 12″, and test resumed by compression.

Interval of rest 1 day.

New gauged length of 10 inches established.

Sectional area considered, 1 square inch, as before.

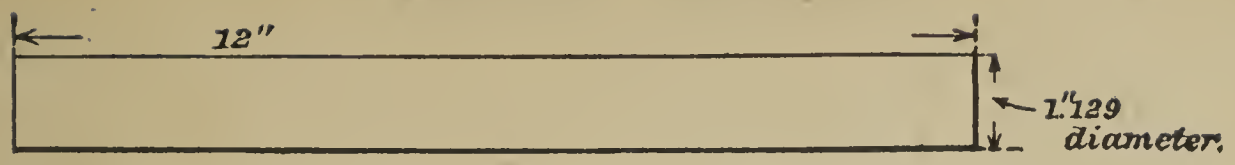
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0012	0.	
10,000	10,000	.0035	0.	
15,000	15,000	.0057	.0008	
20,000	20,000	.0084	.0017	
25,000	25,000	.0119	.0029	
30,000	30,000	.0157	.0049	
35,000	35,000	.0199	.0071	
40,000	40,000	.0251	.0100	
45,000	45,000	.0311	.0139	
50,000	50,000	.0399	.0207	
55,000	55,000	.0513	.0300	
60,000	60,000	.0691	.0458	Compression test discontinued.

Turned down to tensile specimen.
Threaded ends, 1″.10 diameter.
Stem, 8 inches long.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6.″

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0008		
10,000	20,000	.0039	0.	
12,500	25,000	.0051	0.	
15,000	30,000	.0064	.0001	
17,500	35,000	.0075	.0001	
20,000	40,000	.0089	.0004	
22,500	45,000	.0103	.0006	
25,000	50,000	.0119	.0011	
27,500	55,000	.0136	.0017	
30,000	60,000	.0159	.0026	
32,500	65,000	.0191	.0046	
35,000	70,000	.0241	.0082	
36,000	72,000	.0269	.....	
37,000	74,000	.0303	.....	
38,000	76,000	.04	.....	
39,000	78,000	.08	.....	Tensile strength.
34,600	.....	.....	.....	At time of rupture.
0	0	.11	.....	=1.8 per cent.

Elongation of inch sections: ″.08, ″.01, ″.01, ″.00, ″.00, ″.01.
Diameter at fracture, ″.69; area, .374 square inch.
Contraction of area, 25.2 per cent.
Appearance of fracture, granular 80 per cent; fibrous interspersing granular metal 20 per cent.

COMPRESSION SPECIMENS.



No. 5116.

Compression Test.

Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged lengths.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0012	0.	
10,000	10,000	.0030	0.	
15,000	15,000	.0049	0.	
20,000	20,000	.0068	.0001	
25,000	25,000	.0087	.0001	
30,000	30,000	.0107	.0002	
35,000	35,000	.0126	.0004	
40,000	40,000	.0149	.0010	
45,000	45,000	.0179	.0021	
50,000	50,000	.0221	.0047	
55,000	55,000	.0292	.0099	
60,000	60,000	.0438	.0222	

Turned down to tensile specimen with ends 1″.1 diameter.
Stem, 8 inches long.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.
Interval of rest since compression loading, 37 days.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0010	0.	
5,000	10,000	.0020	0.	
7,500	15,000	.0030	0.	
10,000	20,000	.0042	.0002	
12,500	25,000	.0054	.0002	
15,000	30,000	.0067	.0003	
17,500	35,000	.0080	·0005	
20,000	40,000	.0095	.0008	
22,500	45,000	.0111	.0013	
25,000	50,000	.0130	.0021	
27,500	55,000	.0151	.0032	
30,000	60,000	.0179	.0049	
32,500	65,000	.0218	.0075	
35,000	70,000	.0274	.....	
36,000	72,000	.0303	.....	
37.000	74,000	.035	.....	
37,500	75,000	.07	.....	
38,000	76,000	.20	.....	
38,180	76,360	.32	.....	Tensile strength.
36,100	.....	.....	.....	At time of rupture.
0	0	.37	.....	= 6.2 per cent.

Elongation of inch sections: ″.03, ″.04, ″.05, ″.04, ″.05, ″.16*.
Diameter at fracture, ″.74; area, .430 square inch.
Contraction of area, 14. per cent.
Fractured 1″.5 from the neck. Appearance, granular.

No. 5117.

Compression Test.

Length, 12″.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0015	0.	
10,000	10.000	.0032	0.	
15,000	15,000	.0050	0.	
20,000	20,000	.0069	.0001	
25,000	25,000	.0089	.0004	
30,000	35,000	.0107	.0004	
35,000	35,000	.0126	.0005	
40,000	40,000	.0148	.0009	
45,000	45,000	.0176	.0009	
50,000	50,000	.0216	.0040	
55,000	55,000	.0289	.0094	
60,000	60,000	.0450	.0239	
				Rested 12 days without load; test then resumed.
62,500	62,500	.....	.....	Ultimate strength.

Failed by triple flexure.
Test discontinued when the specimen had been bent through 122 degrees, the resistance falling in the meantime to 6,000 pounds.

No. 5118.

Compression Test.

Length, 12″.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Specimen was annealed by heating gradually over a red-hot plate until it acquired the estimated temperature of 1015° Fahr. Cooled immediately in the open air and 12 days later tested by compression.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0016	0.	
10,000	10,000	.0033	0.	
15,000	15,000	.0052	.0001	
20,000	20,000	.0071	.0002	
25,000	25,000	.0090	.0002	
30,000	30,000	.0111	.0003	
31,000	31,000	.0114	.....	
32,000	32,000	.0118	.....	
33,000	33,000	.0121	.....	
34,000	34,000	.0125	.....	
35,000	35,000	.0128	.0003	
36,000	36,000	.0132	.....	
37,000	37,000	.0138	.....	
38,000	38,000	.0140	.....	
39,000	39,000	.0143	.....	
40,000	40,000	.0149	.0006	
41,000	41,000	.0151	.....	
42,000	42,000	.0157	.....	
43,000	43,000	.0161	.....	
44,000	44,000	.0168	.....	
45,000	45,000	.0172	.0010	
46,000	46,000	.0180	.....	
47,000	47,000	.0186	.....	
48,000	48,000	.0192	.....	
49,000	49,000	.0201	.....	
50,000	50,000	.0218	.0038	
51,000	51,000	.0228	.....	
52,000	52,000	.0258	.....	
53,000	53,000	.0293	.....	
54,000	54,000	.0350	.....	
55,000	55,000	.0462	.0258	
55,860	55,860	.....	.....	Ultimate strength.

Failed by triple flexure.

After passing the maximum load the stresses were continued while the deflection of the specimen increased, the resistance diminishing in the meantime.

The test was discontinued when the specimen had been bent 110 degrees, its resistance against further deflection at the time being 6,000 pounds.

TEMPERATURE TESTS.

SECOND SERIES—STEEL BARS.

(For chemical composition see Report of Tests, 1889, page 389.)

601

TENSION TESTS OF METAL.

No. 5242.

MARK 1.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	.....	
5,000	10,000	.0015	.....	
7,500	15,000	.0024	.....	
10,000	20,000	.0033	0.	
12,500	25,000	.0041	.....	
15,000	30,000	.0050	0.	
17,500	35,000	.0060	.....	
20,000	40,000	.0068	0.	
22,500	45,000	.0077	0.	
25,000	50,000	.0086	0.	
25,500	51,000	.0087	.....	
26,000	52,000	.0089	.....	
26,500	53,000	.0090	.....	
27,000	54,000	.0092	.....	
27,500	55,000	.0095	.....	
28,000	56,000	.0096	.....	
28,500	57,000	.0098	.....	
29,000	58,000	.0099	.....	
29,500	59,000	.0102	.....	
29,900	59,800	.....	.....	Elastic limit. Load fell.
26,500	53,000	.0164	.....	
		.0172	.....	
27,000	54,000	.0215	.....	
27,500	55,000	.0345	.....	
		.1230	.....	
28,000	56,000	.1268	.....	
28,500	57,000	.1325	.....	
29,000	58,000	.1120	.....	
29,500	59,000	.1485	.....	
30,000	60,000	.1575	.....	
30,500	61,000	.1690	.....	
31,000	62,000	.1815	.....	
31,500	63,000	.1907	.....	
32,000	64,000	.2080	.....	
32,500	65,000	.21	.....	
33,000	66,000	.23	.....	
33,500	67,000	.24	.....	
34,000	68,000	.26	.....	
34,500	69,000	.27	.....	
35,000	70,000	.30	.....	
35,500	71,000	.32	.....	
36,000	72,000	.35	.....	
36,500	73,000	.37	.....	
37,000	74,000	.41	.....	
37,500	75,000	.45	.....	
38,000	76,000	.53	.....	
38,500	77,000	.61	.....	
39,000	78,000	.74	.....	
39,400	78,800	1.00	.....	Tensile strength.
29,800	.....	.....	.....	At time of rupture.
0	0	1.40	.....	= 28.0 per cent.

Elongation of inch sections, ″.16, ″.22, ′.59*, ″.26, ″.17.
Diameter at fracture, ″.48; area, .181 square inch.
Contraction of area, 63.8 per cent.
Fractured 3″ from the neck. Appearance, fine silky.

No. 5243.

Mark 2.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	.....	
5,000	10,000	.0015	.....	
7,500	15,000	.0025	.....	
10,000	20,000	.0034	0.	
12,500	25,000	.0043	.....	
15,000	30,000	.0052	0.	
17,500	35,000	.0061	.....	
20,000	40,000	.0070	.0002	
22,500	45,000	.0079	.0002	
25,000	50,000	.0089	.0002	
25,500	51,000	.0090	.....	
26,000	52,000	.0092	.....	
26,500	53,000	.0094	.....	
27,000	54,000	.0095	.....	
27,500	55,000	.0097	.0003	
28,000	56,000	.0100	.....	
28,500	57,000	.0102	.....	
29,000	58,000	.0103	.....	
29,500	59,000	.0105	.....	
30,000	60,000	.0107	.0003	
30,300	60,600	.....	.....	Elastic limit. Load fell.
27,500	55,000	.0260	.....	
28,000	56,000	.0915	.....	
28,500	57,000	.0940	.....	
29,000	58,000	.0982	.....	
29,500	59,000	.1032	.....	
30,000	60,000	.1105	.....	
30,500	61,000	.1187	.....	
31,000	62,000	.1250	.....	
31,500	63,000	.1326	.....	
32,000	64,000	.1400	.....	
32,500	65,000	.1470	.....	
33,000	66,000	.1575	.....	
33,500	67,000	.1670	.....	
34,000	68,000	.1775	.....	
34,500	69,000	.1868	.....	
35,000	70,000	.1980	.....	
35,500	71,000	.21	.....	
36,000	72,000	.22	.....	
36,500	73,000	.24	.....	
37,000	74,000	.25	.....	
37,500	75,000	.26	.....	
38,000	76,000	.28	.....	
38,500	77,000	.30	.....	
39,000	78,000	.32	.....	
39,500	79,000	.35	.....	
40,000	80,000	.38	.....	
40,500	81,000	.42	.....	
41,000	82,000	.45	.....	
41,500	83,000	.51	.....	
42,000	84,000	.60	.....	
42,500	85,000	.69	.....	
43,000	86,000	.94	.....	Tensile strength.
34,900	.....	.....	.....	At time of rupture.
0	0	1.33	.....	=26.6 per cent.

Elongation of inch sections, ″.16, ″.24, ″.54*, ″.22, ″.17.
Diameter at fracture, ″.54; area, .229 square inch.
Contraction of area, 54.2 per cent.
Fractured at the middle of stem. Appearance, fine silky.

No. 5548.

Mark 4.

Diameter, ″.714.
Sectional area, .40 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0006	0.	
4,000	10,000	.0016	.....	
6,000	15,000	.0024	.....	
8,000	20,000	.0032	.....	
10,000	25,000	.0041	0.	
12,000	30,000	.0050	0.	
14,000	35,000	.0058	0.	
16,000	40,000	.0066	0.	
18,000	45,000	.0076	0.	
20,000	50,000	.0085	0.	
22,000	55,000	.0094	0.	
22,400	56,000	.0095	.....	
22,800	57,000	.0098	.....	
23,200	58,000	.0099	.....	
23,600	59,000	.0101	.....	
24,000	60,000	.0103	0.	
24,400	61,000	.0105	.....	Elastic limit. Load fell.
22,000	55,000	.0140 .0200	.....	
22,400	56,000	.0938	.....	
22,800	57,000	.0958	.....	
23,200	58,000	.1000	.....	
23,600	59,000	.1038	.....	
24,000	60,000	.1125	.....	
24,400	61,000	.1194	.....	
24,800	62,000	.1252	.....	
25,200	63,000	.1337	.....	
25,600	64,000	.1395	.....	
26,000	65,000	.1435	.1345	
26,400	66,000	.1564	.....	
26,800	67,000	.1636	.....	
27,200	68,000	.1725	.....	
27,600	69,000	.1880	.....	
28,000	70,000	.1995	.1838	
28,400	71,000	.2079	.....	
28,800	72,000	.2228	.....	
29,200	73,000	.2377	.....	
29,600	74,000	.25	.....	
30,000	75,000	.27	.....	
30,400	76,000	.29	.....	
30,800	77,000	.30	.....	
31,200	78,000	.32	.....	
31,600	79,000	.35	.....	
32,000	80,000	.38	.....	
32,400	81,000	.40	.....	
32,800	82,000	.45	.....	
33,200	83,000	.50	.....	
33,600	84,000	.56	.....	
34,000	85,000	.66	.....	
34,400	86,000	.88	.....	Tensile strength.
0	0	1.32	.....	= 26.4 per cent.

Elongation of inch sections, ″.19, ″.23, ″.52*, ″.20, ″.18.
Diameter at fracture, ″.49; area, .189 square inch.
Contraction of area, 52.8 per cent.
Fractured at middle of length. Appearance, fine silky.

No. 5549.

MARK 4.

Diameter, ″.714.
Sectional area, .40 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0006	0.	
4,000	10,000	.0015	.....	
8,000	20,000	.0032	.....	
12,000	30,000	.0052	.0001	
16,000	40,000	.0069	.....	
20,000	50,000	.0088	.0002	
20,400	51,000	.0090	.....	
20,800	52,000	.0091	.....	
21,200	53,000	.0093	.....	
21,600	54,000	.0095	.....	
22,000	55,000	.0097	.0002	
22,000	55,000	.0097	.....	Second application of this load.
.....	55,000	.0098	.....	After 10 minutes.
.....	55,000	.0098	.....	After 15 minutes.
22,400	56,000	.0100	.....	
.....	56,000	.0100	.....	After 10 minutes.
22,800	57,000	.0103	.....	
.....	57,000	.0103	.....	After 10 minutes.
23,200	58,000	.0104	.....	
.....	58,000	.0104	.....	After 10 minutes.
23,600	59,000	.....	.....	Elastic limit. Sustained momentarily, then load fell.
21,600	54,000	.0233	.....	
.....	54,000	.0338	.....	After 5 minutes.
.....	54,000	.0392	.....	After 10 minutes.
.....	54,000	.0585	.....	After 15 minutes.
.....	54,000	.0658	.....	After 20 minutes.
.....	54,000	.0696	.....	After 25 minutes.
.....	54,000	.0728	.....	After 30 minutes.
.....	54,000	.0767	.....	After 35 minutes.
.....	54,000	.0775	.....	After 50 minutes.
22,000	55,000	.0783	.....	
22,400	56,000	.0840	.....	
22,800	57,000	.0870	.....	
23,200	58,000	.0938	.....	
23,600	59,000	.1015	.....	
24,000	60,000	.1095	.....	
24,400	61,000	.1164	.....	
24,800	62,000	.1224	.....	
25,200	63,000	.1300	.....	
25,600	64,000	.1380	.....	
26,000	65,000	.1457	.1320	
26,400	66,000	.1530	.....	
26,800	67,000	.1620	.....	
27,200	68,000	.1732	.....	
27,600	69,000	.1865	.....	
28,000	70,000	.1988	.1830	
28,400	71,000	.2073	.....	
28,800	72,000	.2158	.....	
29,200	73,000	.2355	.....	
29,600	74,000	.25	.....	
30,000	75,000	.27	.....	
30,400	76,000	.29	.....	
30,800	77,000	.31	.....	
31,200	78,000	.32	.....	
31,600	79,000	.34	.....	
32,000	80,000	.38	.....	
32,400	81,000	.41	.....	
32,800	82,000	.45	.....	
33,200	83,000	.50	.....	
33,600	84,000	.55	.....	
34,000	85,000	.63	.....	
34,400	86,000	.78	.....	
34,480	86,200	.91	.....	Tensile strength.
28,900	.....	.....	.....	At time of rupture.
0	.....	1.20	.....	=24. 0 per cent.

Elongation of inch sections, ″.16, ″.18, ″.49*, ″.20, ″.17.
Diameter at fracture, ″.50; area, .196 square inch.
Contraction of area, 51.0 per cent.
Fractured 3.″25 from the neck. Appearance, fine silky.

No. 5241.

MARK 4.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0005	0.	
5,000	10,000	.0012	.....	
7,500	15,000	.0020	.....	
10,000	20,000	.0029	0.	
12,500	25,000	.0038	.....	
15,000	30,000	.0047	.....	
17,500	35,000	.0056	.....	
20,000	40,000	.0065	.0000	
22,500	45.000	.0073	.....	
25,000	50,000	.0083	.0000	
25,500	51,000	.0084	.....	
26,000	52,000	.0087	.....	
26,500	53,000	.0088	.....	
27,000	54,000	.0090	.....	
27,500	55,000	.0091	0.	
28.000	56,000	.0093	.....	
28,500	57,000	.0095	.....	
29,000	58,000	.0097	.....	
29,500	59,000	.0098	.....	Elastic limit.
29,750	59,500	.....	.....	Load fell.
27,500	55,000	.0145	.....	
28,000	56,000	.0460	.....	
28,500	57,000	.0950	.....	
29,000	58,000	.0990	.....	
29,500	59,000	.1029	.....	
30,000	60,000	.1098	.0972	
30,500	61,000	.1160	.....	
31,000	62,000	.1197	.....	
31,500	63,000	.1310	.....	
32,000	64,000	.1390	.....	
32,500	65,000	.1470	.....	
33,000	66,000	.1550	.....	
33,500	67,000	.1612	.....	
34,000	68,000	.1743	.....	
34,500	69,000	.1818	.....	
35,000	70,000	.1940	.....	
35,500	71,000	.2035	.....	
36,000	72,000	.21	.....	
36,500	73,000	.23	.....	
37,000	74,000	.25	.....	
37,500	75,000	.27	.....	
38,000	76,000	.28	.....	
38,500	77,000	.30	.....	
39,000	78,000	.33	.....	
39,500	79,000	.35	.....	
40,000	80,000	.37	.....	
40.500	81,000	.40	.....	
41,000	82,000	.43	.....	
41,500	83,000	.47	.....	
42,000	84,000	.53	.....	
42,500	85,000	.60	.....	
43,000	86,000	.70	.....	
43,410	86,820	.95	.....	Tensile strength.
35,500	.....	.....	.....	At time of rupture.
0	0	1.35	.....	=27.0 per cent.

Elongation of inch sections, ″.17, ″.35, ″.45*, ″.20, ″.18.
Diameter at fracture, ″.55; area, .238 square inch.
Contraction of area, 52.4 per cent.
Fractured 3″ from the neck. Appearance, fine silky.

No. 5244.

Mark 5.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	.....	
5,000	10,000	.0015	.....	
7,500	15,000	.0023	.....	
10,000	20,000	.0032	0.	
12,500	25,000	.0041	.....	
15,000	30,000	.0050	.....	
17,500	35,000	.0059	.....	
20,000	40,000	.0067	0.	
22,500	45,000	.0077	.....	
25,000	50,000	.0086	0.	
27,500	55,000	.0095	.....	
28,000	56,000	.0096	.....	
28,500	57,000	.0097	.....	
29,000	58,000	.0098	.....	
29,500	59,000	.0099	.....	
30,000	60,000	.0101	0.	
30,500	61,000	.0103	.....	
31,000	62,000	.0105	.....	
31,500	63,000	.0107	.....	
32,000	64,000	.0109	.....	
32,100	64,200	.0110	.....	Elastic limit. Load fell.
29,000	58,000	.0165	.....	
29,500	59,000	.0185	.....	
30,000	60,000	.0960	.....	
30,500	61,000	.1008	.....	
31,000	62,000	.1050	.....	
31,500	63,000	.1105	.....	
32,000	64,000	.1175	.....	
32,500	65,000	.1235	.....	
33,000	66,000	.1300	.....	
33,500	67,000	.1356	.....	
34,000	68,000	.1460	.....	
34,500	69,000	.1510	.....	
35,000	70,000	.1670	.....	
35,500	71,000	.1740	.....	
36,000	72,000	.1830	.....	
36,500	73,000	.1910	.....	
37,000	74,000	.20	.....	
37,500	75,000	.22	.....	
38,000	76,000	.24	.....	
38,500	77,000	.25	.....	
39,000	78,000	.26	.....	
39,500	79,000	.28	.....	
40,000	80,000	.29	.....	
40,500	81,000	.31	.....	
41,000	82,000	.34	.....	
41,500	83,000	.38	.....	
42,000	84,000	.41	.....	
42,500	85,000	.45	.....	
43,000	86,000	.48	.....	
43,500	87,000	.56	.....	
44,000	88,000	.64	.....	
44,500	89,000	.79	.....	Tensile strength.
34,300	.....	.....	.....	At time of fracture.
0	0	1.26	.....	= 25.2 per cent.

Elongation of inch sections, ″.15, ″.38, ″.40*, ″.19, ″.14.
Diameter at fracture, ″.51; area, .204 square inch.
Contraction of area, 59.2 per cent.
Fractured 2″.7 from the neck. Appearance, fine silky.

No. 4539.

Mark 6.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	.....	
5,000	10,000	.0015	.....	
7,500	15,000	.0024	.....	
10,000	20,000	.0032	.....	
12,500	25,000	.0041	.....	
15,000	30,000	.0050	0.	
17,500	35,000	.0060	.....	
20,000	40,000	.0068	.0001	
22,500	45,000	.0078	.0002	
25,000	50,000	.0087	.0002	
27,500	55,000	.0096	.0003	
28,000	56,000	.0098	.....	
28,500	57,000	.0100	.....	
29,000	58,000	.0101	.....	
29,500	59,000	.0103	.....	Elastic limit
.....	.....	.....	.....	Load fell.
28,000	56,000	.0225	.....	
28,500	57,000	.0730	.....	
29,000	58,000	.0767	.....	
29,500	59,000	.0810	.....	
30,000	60,000	.0870	.....	
31,000	62,000	.1000	.....	
32,000	64,000	.1107	.....	
33,000	66,000	.1272	.....	
34,000	68,000	.1394	.....	
35,000	70,000	.1570	.....	
36,000	72,000	.17	.....	
37,000	74,000	.19	.....	
38,000	76,000	.22	.....	
39,000	78,000	.24	.....	
40,000	80,000	.27	.....	
41,000	82,000	.31	.....	
42,000	84,000	.38	.....	
43,000	86,000	.46	.....	
44,000	88,000	.63	.....	
44,290	88,580	.78	.....	Tensile strength.
33,200	.....	.....	.....	At time of rupture.
0	0	1.22	.....	=24.4 per cent.

Elongation of inch sections, ″.14, ″.21, ″.57,* ″.18, ″.12.
Diameter at fracture, ″.53; area, .221 square inch.
Contraction of area, 55.8 per cent.
Fractured at the middle of stem. Appearance silky.

No. 4540.

Mark 9.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	.....	
5,000	10,000	.0016	.....	
7,500	15,000	.0024	.....	
10,000	20,000	.0033	.....	
12,500	25,000	.0040	.....	
15,000	30,000	.0049	0.	
17,500	35,000	.0058	.....	
20,000	40,000	.0067	0.	
22,500	45,000	.0075	.....	
25,000	50,000	.0084	0.	
27,500	55,000	.0094	.....	
28,000	56,000	.0095	.....	
28,500	57,000	.0097	.....	Elastic limit.
29,000	58,000	.0102	.....	Load fell.
27,000	54,000	.0330	.....	
27,500	55,000	.0558	.....	
28,000	56,000	.0590	.....	
28,500	57,000	.0607	.....	
29,000	58,000	.0661	.....	
29,500	59,000	.0705	.....	
30,000	60,000	.0765	.....	
31,000	62.000	.0848	.....	
32,000	64,000	.0946	.....	
33,000	66,000	.1052	.....	
34,000	68,000	.1185	.....	
35,000	70,000	.1278	.....	
36,000	72,000	.1423	.....	
37,000	74,000	.1573	.....	
38,000	76,000	.1745	.....	
39,000	78,000	.19	.....	
40,000	80,000	.21	.....	
41,000	82,000	.23	.....	
42,000	84,000	.25	.....	
43,000	86,000	.29	.....	
44,000	88,000	.33	.....	
45,000	90,000	.38	.....	
46,000	92,000	.46	.....	
47,000	94,000	.60	.....	
47,580	95,160	.77	.....	Tensile strength.
39,200	.....	.....	.....	At time of rupture.
0	0	1.18	.....	=23.6 per cent.

Elongation of inch sections: ″.14, ″.20, ″.51*, ″.20, ″.13.
Diameter at fracture, ″.57; area, .255 square inch.
Contraction of area, 49 per cent.
Fractured at the middle of stem. Appearance, silky.

No. 4541.

Mark 11.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	.....	
5,000	10,000	.0016	.....	
7,500	15,000	.0025	.....	
10,000	20,000	.0033	.....	
12,500	25,000	.0042	.....	
15,000	30,000	.0051	.....	
17,500	35,000	.0060	.....	
20,000	40,000	.0068	0.	
22,500	45,000	.0077	.....	
25,000	50,000	.0085	0.	
27,500	55,000	.0095	0.	
29,500	59,000	.0104	0.	
32,000	64,000	.0112	.....	
32,500	65,000	.0114	.....	
33,000	66,000	.0115	.....	
33,500	67,000	.0117	.....	Elastic limit.
				Load fell.
31,000	62,000	.0245	.....	
31,500	63,000	.0450	.....	
32,000	64,000	.0468	.....	
32,500	65,000	.0490	.....	
33,000	66,000	.0520	.....	
33,500	67,000	.0548	.....	
34,000	68,000	.0590	.....	
35,000	70,000	.0648	....	
36,000	72,000	.0735	.....	
37,000	74,000	.0781	.....	
38,000	76,000	.0870	.....	
39,000	78,000	.0938	.....	
40,000	80,000	.1020	.....	
41,000	82,000	.1105	.....	
42,000	84,000	.1200	.....	
43,000	86,000	.1292	.....	
44,000	88,000	.1390	.....	
45,000	90,000	.1519	.....	
46,000	92,000	.1620	.....	
47,000	94,000	.1747	.....	
48,000	96,000	.19	.....	
49,000	98,000	.20	.....	
50,000	100,000	.22	.....	
51,000	102,000	.23	.....	
52,000	104,000	.26	.....	
53,000	106,000	.30	.....	
54,000	108,000	.33	.....	
55,000	110,000	.38	.....	
56,000	112,000	.47	.....	
56,980	113,960	.64	.....	Tensile strength.
50,400	.....	.....	.....	At time of rupture.
0	0	.88	.....	= 17.6 per cent.

Elongation of inch sections: ″.10, ″.16, ″.37*, ″.14, ″.11.
Diameter at fracture, ″.64; area, .322 square inch.
Contraction of area, 35.6 per cent.
Fractured at the middle of stem. Appearance, silky, interspersed with fine granulation.

No. 4542.

Mark 13.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	.....	
5,000	10,000	.0016	.....	
7,500	15,000	.0025	.....	
10,000	20,000	.0032	.....	
12,500	25,000	.0041	.....	
15,000	30,000	.0050	.0001	
17,500	35,000	.0059	.....	
20,000	40,000	.0067	.....	
22,500	45,000	.0077	.....	
25,000	50,000	.0086	.0001	
27,500	55,000	.0095	.....	
30,000	60,000	0103	.0002	
32,500	65,000	.0113	.....	
35,000	70,000	.0122	.0003	
35,500	71,000	.0124	.....	
36,000	72,000	.0126	.....	
36,500	73,000	.0128	.....	Elastic limit.
37,000	74,000	.0134	.....	Load fell.
35,000	70,000	.0309	.....	
35,500	71,000	.0436	.....	
36,000	72,000	.0457	.....	
36,500	73,000	.0484	.....	
37,000	74,000	.0513	.....	
37,500	75,000	.0540	.....	
38,000	76,000	.0566	.....	
39,000	78,000	.0637	.....	
40,000	80,000	.0686	.....	
41,000	82,000	.0748	.....	
42,000	84,000	.0805	.....	
43,000	86,000	.0872	.....	
44,000	88,000	.0929	.....	
45,000	90,000	.1008	.....	
46,000	92,000	.1067	.....	
47,000	94,000	.1152	.....	
48,000	96,000	.1230	.....	
49,000	98,000	.1310	.....	
50,000	100,000	.1395	.1155	
51,000	102,000	.15	.....	
52,000	104,000	.16	.....	
53,000	106,000	.17	.....	
54,000	108,000	.18	.....	
55,000	110,000	.19	.....	
56,000	112,000	.20	.....	
57,000	114,000	.22	.....	
58,000	116,000	.25	.....	
59,000	118,000	.27	.....	
60,000	120,000	.30	.....	
61,000	122,000	.35	.....	
63,000	126,000	.54	.....	
63,450	126,900	.....	.....	Tensile strength.
59,800	.....	.....	.....	At time of rupture.
0	0	.75	.....	= 15 per cent.

Elongation of inch sections: ″.10, ″.19*, ″.24*, ″.13, ″.09.
Diameter at fracture, ″.71; area, .396 square inch.
Contraction of area, 20.8 per cent.
Fractured 2″.3 from the neck. Appearance, fine granular, radiating from a dull spot at the circumference.

No. 4546.

Mark 16.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	.....	
5,000	10,000	.0015	.....	
7,500	15,000	.0024	.....	
10,000	20,000	.0033	.....	
12,500	25,000	.0040	.....	
15,000	30,000	.0050	0.	
17,500	35,000	.0058	.....	
20,000	40,000	.0067	.....	
22,500	45,000	.0075	.....	
25,000	50,000	.0084	0.	
27,500	55,000	.0093	.....	
30,000	60,000	.0102	0.	
31,000	62,000	.0105	.....	
32,000	64,000	.0108	.....	
32,500	65,000	.0110	.....	
33,000	66,000	.0112	.....	
34,000	68,000	.0115	.....	Elastic limit.
34,500	69,000	.0121	.....	Load fell.
34,000	68,000	.0158	.....	
		.0197	.....	
34,500	69,000	.0250	.....	
35,000	70,000	.0278	.....	
35,500	71,000	.0295	.....	
36,000	72,000	.0317	.....	
37,000	74,000	.0367	.....	
38,000	76,000	.0419	.....	
39,000	78,000	.0465	.....	
40,000	80,000	.0513	.....	
41,000	82,000	.0567	.....	
42,000	84,000	.0609	.....	
43,000	86,000	.0677	.....	
44,000	88,000	.0721	.....	
45,000	90,000	.0778	.....	
46,000	92,000	.0815	.....	
47,000	94,000	.0881	.....	
48,000	96,000	.0956	.....	
49,000	98,000	.1018	.....	
50,000	100,000	.1097	.0850	
50,000	100,000	.1119	.0885	
500	1,000	.0885	.....	Readings after bar had been loaded with 100,000 pounds per square inch.
5,000	10,000	.0898	.....	
10,000	20,000	.0918	.....	
15,000	30,000	.0937	.....	
20,000	40,000	.0957	.....	
25,000	50,000	.0980	.....	
30,000	60,000	.1001	.....	
35,000	70,000	.1024	.....	
40,000	80,000	.1050	.....	
45,000	90,000	.1083	.....	
40,000	80,000	.1065	.....	
35,000	70,000	.1046	.....	
30,000	60,000	.1027	.....	
25,000	50,000	.1007	.....	
20,000	40,000	.0987	.....	
15,000	30,000	.0965	.....	
10,000	20,000	.0940	.....	
5,000	10,000	.0915	.....	
500	1,000	.0888	.....	

No. 4546—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds	*Pounds.*	*Inch.*	*Inch.*	
52,000	104,000	.12	.....	
54,000	108,000	.14	.....	
56,000	112,000	.16	.....	
58,000	116,000	.19	.....	
60,000	120,000	.21	.....	
62,000	124,000	.24	.....	
64,000	128,000	.30	.....	
66,000	132,000	.38	.....	
66,880	133,760	.50	.....	Tensile strength.
62,900	.....	.....	.....	At time of fraction.
0	0	.65	.....	=13. per cent.

Elongation of inch sections: ″.09, ″.10, ″.17, ″.20*, ″.09.
Diameter at fracture, ″.72; area, .407 square inch.
Contraction of area, 18.6 per cent.
Fractured 2″.3 from the neck. Appearance, granular, radiating from a dull spot at the circumference.

No. 4543.

Mark 17.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged lengths.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	.....	
5,000	10,000	.0015	.....	
7,500	15,000	.0023	.....	
10,000	20,000	.0031	.....	
12,500	25,000	.0040	.....	
15,000	30,000	.0048	0.	
17,500	35,000	.0056	.....	
20,000	40,000	.0064	.....	
22,500	45,000	.0073	.....	
25,000	50,000	.0082	0.	
27,500	55,000	.0091	.....	
30,000	60,000	.0100	0.	
32,500	65,000	.0109	.....	
34,500	69,000	.0118	.....	Elastic limit.
35,000	70,000	.....	.....	Load fell.
32,000	64,000	.0297	.....	
32,500	65,000	.0430	.....	
33,000	66,000	.0438	.....	
33,500	67,000	.0448	.....	
34,000	68,000	.0468	.....	
34,500	69,000	.0490	.....	
35,000	70,000	.0507	.....	
36,000	72,000	.0559	.....	
37,000	74,000	.0593	.....	
38,000	76,000	.0641	.....	
39,000	78,000	.0684	.....	
40,000	80,000	.0724	.....	
41,000	82,000	.0778	.....	
42,000	84,000	.0828	.....	
43,000	86,000	.0875	.....	
44,000	88,000	.0935	.....	
45,000	90,000	.0985	.....	
46,000	92,000	.1042	.....	
47,000	94,000	.1102	.....	
48,000	96,000	.1160	.....	
49,000	98,000	.1225	.....	
50,000	100,000	.1300	.1009	
52,000	104,000	.16	.....	
54,000	108,000	.18	.....	
56,000	112,000	.20	.....	
58,000	116,000	.23	.....	
60,000	120,000	.29	.....	
62,000	124,000	.42	.....	
62,750	125,500	.49	.....	Tensile strength.
62,400	.....	.....	.....	At time of rupture.
0	0	.46	.....	=9.2 per cent.

Elongation of inch sections: ″.08, ″.12*, ″.10, ″.08, ″.08.
Diameter at fracture, ″.75; area, .442 square inch.
Contraction of area, 11.6 per cent.
Fractured 1″.85 from the neck. Appearance, fine granular.

No. 4544.

Mark 19.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0006	.....	
5,000	10,000	.0014	.....	
7,500	15,000	.0022	.....	
10,000	20,000	.0030	.....	
12,500	25,000	.0039	.....	
15,000	30,000	.0047	0.	
17,500	35,000	.0056	.....	
20,000	40,000	.0066	.....	
22,500	45,000	.0074	.....	
25,000	50,000	.0083	.0002	
27,500	55,000	.0092	.....	
30,000	60,000	.0100	.0002	
32,500	65,000	.0109	.....	
34,000	68,000	.0115	.....	Elastic limit. Load fell.
31,000	62,000	.0179	.....	
31,500	63,000	.0230	.....	
32,000	64,000	.0432	.....	
32,500	65,000	.0460	.....	
33,000	66,000	.0475	.....	
33,500	67,000	.0488	.....	
34,000	68,000	.0504	.....	
34,500	69,000	.0527	.....	
35,000	70,000	.0549	.....	
36,000	72,000	.0591	.....	
37,000	74,000	.0637	.....	
38,000	76,000	.0677	.....	
39,000	78,000	.0723	.....	
40,000	80,000	.0775	.....	
41,000	82,000	.0815	.....	
42,000	84,000	.0870	.....	
43,000	86,000	.0920	.....	
44,000	88,000	.0970	.....	
45,000	90,000	.1028	.....	
46,000	92,000	.1100	.....	
47,000	94,000	.1160	.....	
48,000	96,000	.1223	.....	
49,000	98,000	.1298	.....	
50,000	100,000	.1378	.1082	
52,000	104,000	.16	.....	
54,000	108,000	.18	.....	
56,000	112,000	.20	.....	
58,000	116,000	.25	.....	
60,000	120,000	.31	.....	
61,800	123,600	.....	.....	Tensile strength.
0	0	.50	.....	= 10 per cent.

Fractured under the maximum load.
Elongation of inch sections: ″.08, ″.13*, ″.13*, ″.09, ″.07.
Diameter at fracture, ″.75; area, .442 square inch.
Contraction of area, 11.6 per cent.
Fractured 2″.33 from the neck. Appearance of fracture, fine granular.

No. 4545.

Mark 22.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	.....	
5,000	10,000	.0015	.....	
7,500	15,000	.0023	.....	
10,000	20,000	.0033	.....	
12,500	25,000	.0040	.....	
15,000	30,000	.0049	0.	
17,500	35,000	.0057	.....	
20,000	40,000	.0065	.....	
22,500	45,000	.0075	.....	
25,000	50,000	.0082	0.	
27,500	55,000	.0092	.....	
30,000	60,000	.0100	0.	
32,500	65,000	.0108	.....	
35,000	70,000	.0117	0.	
37,500	75,000	.0125	.....	
40,000	80,000	.0135	0.	
40,500	81,000	.0137	.....	Elastic limit. Load fell.
38,000	76,000	.0267	.....	
38,500	77,000	.0600	.....	
39,000	78,000	.0610	.....	
39,500	79,000	.0628	.....	
40,000	80,000	.0640	.....	
40,500	81,000	.0658	.....	
41,000	82,000	.0678	.....	
42,000	84,000	.0720	.....	
43,000	86,000	.0768	.....	
44,000	88,000	.0802	.....	
45,000	90,000	.0846	.....	
46,000	92,000	.0895	.....	
47,000	94,000	.0944	.....	
48,000	96,000	.0992	.....	
49,000	98,000	.1060	.....	
50,000	100,000	.1120	.0825	
52,000	104,000	.12	.....	
54,000	108,000	.13	.....	
56,000	112,000	.16	.....	
58,000	116,000	.19	.....	
60,000	120,000	.22	.....	
62,000	124,000	.29	.....	
62,850	125,700	.....	.....	Tensile strength.
0	0	.26	.....	= 5.2 per cent.

Fractured under the maximum stress at center punch mark defining limit of gauged length.

Elongation of inch sections: ″.04, ″.05, ″.05, ″.06, ″.06*.

Fractured at the neck. Appearance, fine granular.

TEMPERATURE TESTS, SECOND SERIES, STEEL, TABULATION OF TENSION TESTS OF METAL.

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 5 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
				Total.	Per sq. inch.	Total.	Per sq. inch.	Inches.	Per cent.				
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			" *Sq. in.*	*Per ct.*		" " " " "
5242	1	.798	.50	29,900	59,800	39,400	78,800	1.40	28.0	Diam., .48=.181	63.8	Fine silky	.16, .22, .59*, .26, .17
5243	2	.798	.50	30,300	60,600	43,400	86,000	1.33	26.6	Diam., .54=.229	54.2	Fine silky	.16, .24, .54*, .22, .17
5548	4	.714	.40	24,400	61,000	34,400	86,000	1.32	26.4	Diam., .49=.189	52.8	Fine silky	.19, .23, .52*, .20, .18
5549	4	.714	.40	23,600	59,000	34,480	86,200	1.20	24.0	Diam., .50=.196	51.0	Fine silky	.16, .18, .49*, .20, .17
5241	4	.798	.50	29,500	59,000	43,410	86,820	1.35	27.0	Diam., .55=.238	52.4	Fine silky	.17, .35, .45*, .20, .18
5244	5	.798	.50	32,100	64,200	44,500	89,000	1.26	25.2	Diam., .51=.204	59.2	Fine silky	.15, .38, .40*, .19, .14
4539	6	.798	.50	29,500	59,000	44,290	88,580	1.22	24.4	Diam., .53=.221	55.8	Silky	.14, .21, .57*, .18, .12
4540	9	.798	.50	28,500	57,000	47,580	95,160	1.18	23.6	Dlam., .57=.255	49.0	Silky	.14, .20, .51*, .20, .13
4541	11	.798	.50	33,500	67,000	56,980	113,960	.88	17.6	Diam., .64=.322	35.6	Silky and fine granular	.10, .16, .37*, .14, .11
4542	13	.798	.50	36,500	73,000	63,450	126,900	.75	15.0	Diam., .71=.396	20.8	Fine granular, dull spot	.10, .19*, .24*, .13, .09
4546	16	.798	.50	34,000	68,000	66,880	133,760	.65	13.0	Diam., .72=.407	18.6	Granular, dull spot	.09, .10, .17, .20*, .09
4543	17	.798	.50	34,500	69,000	62,750	125,500	.46	9.2	Diam., ,75=.442	11.6	Fine granular	.08, .12*, .10, .08, .08
4544	19	.798	.50	34,000	68,000	61,800	123,600	.50	10.0	Diam., .75=.442	11.6	Fine granular	.08, 13*, .13*, .09, .07
4545	22	.798	.50	40,500	81,000	62,850	125,700	.26	5.2	Broke at neck..	.....	Fine granular	.04, .05, .05, .06, .06

TEMPERATURE TESTS.

Compressed bars tested after a period of rest and other special treatment.

These special tests, with bars from the second lot of metal intended for temperature tests, were made for the purpose of supplementing a current series of tests upon the effect of overstraining and alternate tensile and compressive stresses on steel and cast iron, supplying data upon material embracing a wide range in chemical composition.

Test 3346*a*. Steel marked 1.

The tensile strength of this metal, shown by specimen No. 5242 recorded in the section of temperature tests comprising the tensile tests of the metal, was 78,800 pounds per square inch. It had an elastic limit of 59,800 pounds per square inch, and the test was characterized by a fall of the load immediately after the elastic limit was reached, when stretching proceeded under 53,000 pounds per square inch tension.

With the present specimen, the elastic limit in the original compression test was 56,000 pounds per square inch. This was the maximum compression stress applied, after which the bar rested without load a period of 19 months. At the expiration of this time the test was resumed, loading the metal by tension.

Apparently there was a set of ″.0001 at 15,000 pounds per square inch, but no additional set was observed at 40,000 pounds per square inch. At 45,000 pounds per square inch the set was ″.0004. The elastic limit taken at 46,000 pounds per square inch marked the limit at which elongations began to increase in their rate.

There was no yielding point or jog in the tensile curve like that shown by specimen No. 5242.

Steel marked No. 4 is represented by the test of eleven special specimens.

In the plain tests the elastic limit ranged from 59,000 to 61,000 pounds per square inch and the tensile strength from 86,000 to 86,820 pounds per square inch.

Under compression the primitive elastic limit is substantially the same as in tension.

Specimen No. 3343 was first loaded by compression with 60,000 pounds per square inch; 12 days and 16 hours later it was tested by tension, at which time the elastic limit appeared to be 35,000 pounds per square inch. The tensile stresses were increased to 50,000 pounds per square inch, causing a permanent set of ″.0370 in 5 inches gauged length.

The specimen was then set aside and rested without load a period of 18 months, at the end of which time the test by tension was resumed and completed.

The elastic limit was found to be 64,550 pounds per square inch, or 14,550 pounds higher than the maximum tensile stress which was applied before the period of rest.

It is a notable feature of this test that there occurred a slight jog in the curve after this load of 64,550 pounds per square inch was applied, when the metal stretched under the reduced load of 63,000 pounds per square inch.

Commonly, an earlier overstraining by compression eliminates this feature when subsequently tested by tension.

After having been loaded with 65,000 pounds per square inch, there followed another shorter period of rest of 21 days. Within this time there occurred a further exaltation of the elastic limit, and

68,000 pounds per square inch tension was applied without causing an increase in permanent set.

Then followed a rest of 14 days, and the test was resumed under compression stress.

The elastic limit was now 34,000 pounds per square inch. After applying 60,000 pounds per square inch compression the specimen was turned down in diameter for the purpose of straightening the stem, the stress reversed, and the metal ruptured by tension.

There was no well-defined elastic limit, the sets showing a gradual increase after 35,000 pounds per square inch had been passed.

The bar had a tensile strength of 90,450 pounds per square inch on the last sectional area to which the stem had been turned down.

Specimen No. 3344 displayed a similiar behavior to that last described.

It was first loaded by compression with 60,000 pounds per square inch and showed an elastic limit of 59,000 pounds per square inch. The stresses were reversed and the elastic limit in tension had fallen to 35,000 pounds per square inch. The loads were increased to 70,000 pounds per square inch and a large number of measurements taken from time to time for the purpose of showing the disturbed elastic properties, the curves under ascending and descending stresses following different paths, indicating a variable modulus of elasticity.

After resting without load 18 months, 83,000 pounds per square inch tension was once applied without increasing the permanent set, and the curves under ascending and descending loads coincided.

Eighty-three thousand pounds per square inch tension was applied a second time, and sustained 10 minutes. The immediate elongation caused by this load was the same as in the first instance. After 2 minutes time the elongation increased ″.0002 additional; after 5 minutes, ″.0008 more.

Between 5 and 8 minutes rapid stretching set in and the elongation increased ″.0855 over the first reading. At the end of 10 minutes the total increase was ″.0895.

Repeating the observations under descending and ascending stresses the curves now followed different paths. This behavior confirmed previous experiments in which it appeared that distortion was the direct cause of a disturbed modulus of elasticity, and that stress unaccompanied by permanent set did not effect such a disturbance.

Specimen No. 3347*a*, after having been overstrained in both compression and tension, was heated a dull red color and cooled in the open air.

Under the tensile stresses which followed heating there occurred a jog in the curve immediately after the new elastic limit was passed. Yielding went on under reduced stresses. This appeared to be a restoration, the result of the heating. Just before heating this feature was not present.

Specimen No. 3349*a* was alternately loaded with 70,000 pounds per square inch tension and 50,000 pounds per square inch compression, in each direction 20 times. The final tensile strength developed was 91,520 pounds per square inch, referred to the sectional area at the time of the last test, which is seen to be higher than the tensile strength of the specimens once loaded.

Other specimens of this series which were loaded by alternate stresses similarly showed high in tensile strength.

Specimen No. 3345*b*, steel marked 9, when first tested had an elastic limit in compression of 58,000 pounds per square inch. The metal was

given a permanent set of ″.0488 on a gauged length of 5 inches. In the following test by tension, an interval of rest of 13 days intervening, the elastic limit was approximately 29,000 pounds per square inch.

A set of ″.0380 in a tensile direction was given the specimen, and 20 hours later compression loads were again applied. After applying 30,000 pounds per square inch compression the test was discontinued. At this time, however, the metal took permanent sets which were increasing with each increment of loss.

The metal rested without load 19 months and 8 days, at the expiration of which time the test was resumed under compression stresses as before.

Whereas just before resting a load of 30,000 pounds per square inch caused a permanent set of ″.0020, and with indications that higher stresses would have caused increased set, now the metal endured a load of 52,000 pounds per square inch compression and no additional set was developed. The stresses were reversed and a load of 55,000 pounds per square inch tension did not cause an appreciable set.

From this it appears that there was an exaltation in the compressive elastic limit affected during the interval of rest.

Another specimen, No. 3355, of steel marked 9, was strained by tension with 70,000 pounds per square inch; then rested 18 months and test by tension resumed.

Its behavior was similar to that of other overstrained specimens, the modulus of elasticity was variable immediately after overstraining, recovered and was nearly uniform after resting, and the elastic limit was raised by resting.

Stresses were increased until the tensile strength was reached, but before rupture was completed and while local contraction was going on under reduced loads, the stress was released and the specimen removed from the testing machine.

The stress on the specimen when released was 45,000 pounds, the minimum diameter at the time ″.68; hence the maximum stress was 123,970 pounds per square inch.

The specimen was turned down cylindrical to ″.672 diameter, returned to the testing machine, and ruptured. The tensile strength was 38,200 pounds, or 107,610 pounds per square inch on the reduced sectional area, the point of rupture being 3 inches from the place of minimum diameter before turning down.

No. 3346*a*.

Mark 1.

Initially compressed under 56,000 pounds per square inch, which caused a permanent set of ″.0948 in 5 inches.

Rested 19 months, stem then turned down from ″.798 to ″.746 diameter for the purpose of straightening, and tested by tension.

Sectional area, .437 square inch.

New gauged length of 5″ established.

[See Report, 1889, page 436, for compression test.]

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
437	1,000	0.	0.	Initial load.
2,185	5,000	.0007	0.	
4,370	10,000	.0015	0.	
6,555	15,000	.0024	.0001	
8,740	20,000	.0034	.0001	
10,925	25,000	.0043	.0001	
13,110	30,000	.0052	.0001	
15,295	35,000	.0061	.0001	
17,480	40,000	.0070	.0001	
19,665	45,000	.0081	.0004	
20,102	46,000	.0084	.....	Elastic limit.
20,539	47,000	.0091	.....	
20,976	48,000	.0382	.....	
21,413	39,000	.0436	.....	
21,850	50,000	.0486	.0393	
22,287	51,000	.0535	.....	
22,724	52,000	.0574	.....	
23,598	54,000	.0737	.....	
24,472	56,000	.0881	.....	
25,346	58,000	.1013	.....	
26,220	60,000	.1178	.1056	
27,094	62,000	.1379	.....	
27,968	64,000	.1590	.....	
28,842	66,000	.1793	.....	
29,716	68,000	.21	.....	
30,590	70,000	.23	.....	
31,464	72,000	.28	.....	
32,338	74,000	.32	.....	
33,212	76,000	.39	.....	
34,086	78,000	.48	.....	
34,960	80,000	.71	.....	Tensile strength.
26,200	.....	.....	.....	At time of rupture.
0	0	1.20	.....	= 24.0 per cent.

Elongation of inch sections, ″.13, ″.17, ″.54*, ″.22, ″.14.

Diameter at fracture, ″.48; area, .181 square inch.

Contraction of area, 58.6 per cent.

Fractured 3″ from the neck. Appearance, fine silky.

No. 3343*a*.

Mark 4.

This specimen was initially compressed with 60,000 pounds per square inch, causing a permanent set of ″.0785 in 5 inches.

Bar rested 12 days 16 hours, then stem turned down from 1″.0092 to ″.961 for the purpose of straightening, and tested by tension.

Sectional area, .725 square inch.

Gauged length, 5″.

Tension loads applied up to 50,000 pounds per square inch, causing a permanent set of .0370 square inch.

Tension test resumed after resting 18 months.

[See Report, 1889, page 409, for previous tests.]

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
725	1,000	0	.0370	Micrometer reset at last permanent set.
7,250	10,000	.0385	.....	
14,500	20,000	.0402	.....	
21,750	30,000	.0420	.....	
29,000	40,000	.0437	.....	
21,750	30,000	.0420	.....	
14,500	20,000	.0402	.....	
7,250	10,000	.0385	.0370	
29,000	40,000	.0437	.....	
32,625	45,000	.0447	.....	
29,000	40,000	.0437	.....	
21,750	30,000	.0420	.....	
14,500	20,000	.0402	.....	
7,250	10,000	.0385	.0370	
34,075	47,000	.0455	.....	
34,800	48,000	.0457	.....	
35,525	49,000	.0458	.....	
36,250	50,000	.0460	.....	
32,625	45,000	.0452	.....	
29,000	40,000	.0443	.....	
21,750	30,000	.0428	.....	
14,500	20,000	.0410	.....	
7,250	10,000	.0393	.0378	
7,250	10,000	.0393	.....	
14,500	20,000	.0410	.....	
21,750	30,000	.0428	.....	
29,000	40,000	.0446	.....	
36,250	50,000	.0463	.....	
36,975	51,000	.0465	.....	
37,700	52,000	.0467	.....	
38,425	53,000	.0469	.....	
39,150	54,000	.0470	.....	
39,875	55,000	.0471	.0389	
40,600	56,000	.0486	.....	
41,325	57,000	.0488	.....	
42,050	58,000	.0490	.....	
42,775	59,000	.0491	.....	
43,500	60,000	.0490	.....	Micrometer found out of order and readjusted.
39,875	55,000	.0480	.....	
36,250	50,000	.0472	.....	
29,000	40,000	.0455	.....	
21,750	30,000	.0437	.....	
14,500	20,000	.0420	.....	
7,250	10,000	.0403	.0386	
7,250	10,000	.0403	.....	
14,500	20,000	.0420	.....	
21,750	30,000	.0438	.....	
29,000	40,000	.0455	.....	
36,250	50,000	.0472	.....	
39,875	55,000	.0480	.....	
43,500	60,000	.0490	.....	
44,225	61,000	.0491	.....	
44,950	62,000	.0492	.....	
45,675	63,000	.0491	.....	
46,400	64,000	.0495	.....	
46,800	64,550	.....	.....	Elastic limit.
45,675	63,000	.0850	.....	
46,400	64,000	.1032	.....	
47,125	65,000	.1082	.....	

No. 3343*a*—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
43,500	60,000	.1074	.....	
36,250	50,000	.1055	.....	
29,000	40,000	.1035	.....	
21,750	30,000	.1015	.....	
14,500	20,000	.0994	.....	
7,250	10,000	.0972	.0951	
7,250	10,000	.0968	.....	
14,500	20,000	.0987	.....	
21,750	30,000	.1007	.....	
29,000	40,000	.1027	.....	
36,250	50,000	.1047	.....	
43,500	60,000	.1070	.....	
36,250	50,000	.1052	.....	
29,000	40,000	.1034	.....	
21,750	30,000	.1014	.....	
14,500	20,000	.0995	.....	
7,250	10,000	.0974	.0954	
7,250	10,000	.0970	.....	
14,500	20,000	.0990	.....	
21,750	30,000	.1010	.....	
29,000	40,000	.1030	.....	
21,750	30,000	.1011	.....	
14,500	20,000	.0992	.....	
7,250	10,000	.0973	.0955	
7,250	10,000	.0972	.....	
14,500	20,000	.0990	.....	
21,750	30,000	.1010	.....	
29,000	40,000	.1030	.....	
36,250	50,000	.1050	.....	
29,000	40,000	.1032	.....	
21,750	30,000	.1012	.....	
14,500	20,000	.0994	.....	
7,250	10,000	.0975	.0955	
7,250	10,000	.0972	.....	
14,500	20,000	.0990	.....	
21,750	30,000	.1010	.....	
29,000	40,000	.1030	.....	
36,250	50,000	.1050	.....	
43,500	60,000	.1070	.....	
36,250	50,000	.1055	.....	
29,000	40,000	.1035	.....	
21,750	30,000	.1015	.....	
14,500	20,000	.0995	.....	
7,250	10,000	.0975	.0955	Bar removed from machine.
		Test resumed after resting 21 days.		
725	1,000	.....	.0955	Micrometer reset to last reading.
7,720	10,000	.0970	.....	
14,500	20,000	.0989	.....	
21,750	30,000	.1007	.....	
29,000	40,000	.1025	.....	
36,250	50,000	.1043	.....	
29,000	40,000	.1025	.....	
21,750	30,000	.1007	.....	
14,500	20,000	.0989	.....	
7,250	10,000	.0970	.0955	
36,250	50,000	.1042	.....	
43,500	60,000	.1060	.....	
36,250	50,000	.1042	.0955	
43,500	60,000	.1062	.0955	
43,500	60,000	.1062	.....	
44,225	61,000	.1063	.....	
44,950	62,000	.1065	.....	
45,675	63,000	.1067	.....	
46,400	64,000	.1069	.....	
47,125	65,000	.1070	.0955	
47,850	66,000	.1072	.....	
48,575	67,000	.1075	.....	
49,300	68,000	.1077	.0955	

After a rest of 14 days without load, test resumed under compression stresses.

Sectional area assumed to have remained at .725 square inch.

Gauged length, 5″.0955.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
725	1,000	0.	0.	Initial load.
3,625	5,000	.0006	0.	
7,250	10,000	.0015	0.	
10,875	15,000	.0024	0.	
14,500	20,000	.0033	0.	
18,125	25,000	.0041	0.	
21,750	30,000	.0050	0.	
24,650	34,000	.....	.....	Elastic limit.
25,375	35,000	.0062	.0005	
26,100	36,000	.0065	.....	
26,825	37,000	.0069	.....	
27,550	38,000	.0073	.....	
28,275	39,000	.0077	.....	
29,000	40,000	.0081	.0013	
29,725	41,000	.0087	.....	
30,450	42,000	.0091	.....	
31,175	43,000	.0097	.....	
31,900	44,000	.0103	.....	
32,625	45,000	.0111	.0032	
33,350	46,000	.0117	.....	
34,075	47,000	.0127	.....	
34,800	48,000	.0134	.....	
35,525	49,000	.0145	.....	
36,250	50,000	.0156	.0068	
37,700	52,000	.0182	.....	
39,150	54,000	.0202	.....	
40,600	56,000	.0250	.....	
42,050	58,000	.0267	.....	
43,500	60,000	.0322	.0215	

Stem turned down to ″.714 diameter and test resumed under tension stresses.

Interval of rest 22 hours.

Sectional area, .40 square inch.

New gauged length of 5″ established.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0007	0.	
4,000	10,000	.0016	0.	
6,000	15,000	.0026	.0002	
8,000	20,000	.0034	.0002	
10,000	25,000	.0042	.0001	
12,000	30,000	.0052	.0001	
14,000	35,000	.0062	.0002	
14,400	36,000	.0064	.....	
14,800	37,000	.0067	.....	
15,200	38,000	.0069	.....	
15,600	39,000	.0072	.....	
16,000	40,000	.0074	.0005	
16,400	41,000	.0078	.....	
16,800	42,000	.0081	.....	
17,200	43,000	.0084	.....	
17,600	44,000	.0087	.....	
18,000	45,000	.0092	.0012	
18,400	46,000	.0095	.....	
18,800	47,000	.0099	.....	
19,200	48,000	.0105	.....	
19,600	49,000	.0109	.....	
20,000	50,000	.0115	.0027	
20,400	51,000	.0122	.....	
20,800	52,000	.0127	.....	
21,200	53,000	.0133	.....	
21,600	54,000	.0140	.....	
22,000	55,000	.0148	.0050	
22,400	56,000	.0158	.....	
22,800	57,000	.0166	.....	
23,200	58,000	.0177	.....	
23,600	59,000	.0188	.....	
24,000	60,000	.0201	.0093	
24,400	61,000	.0215	.....	
24,800	62,000	.0226	.....	
25,200	63,000	.0241	.....	
25,600	64,000	.0259	.....	
26,000	65,000	.0278	.0158	
26,400	66,000	.0301	.....	
26,800	67,000	.0320	.....	
27,200	68,000	.0345	.....	
27,600	69,000	.0381	.....	
28,000	70,000	.0425	.0288	
28,800	72,000	.0555	.....	
29,600	74,000	.0754	.....	
30,400	76,000	.0948	.....	
31,200	78,000	.1160	.....	
32,000	80,000	.1371	.1201	
32,800	82,000	.17	.....	
33,600	84,000	.20	.....	
34,400	86,000	.25	.....	
35,200	88,000	.30	.....	
36,000	90,000	.47	.....	
36,180	90,450	.51	.....	Tensile strength.
29,900	.....	.....	.....	At time of rupture.
0	0	.93	.....	er cent.

Elongation of inch sections, ″.10, ″.11, ″.21, ″.38*, ″.13.
Diameter at fracture, ″.50; area, .196 square inch.
Contraction of area, 51.0 per cent.
Fractured 2″,75 from the neck. Appearance, fine silky.

No. 3344*a*.

Mark 4.

This specimen was initially compressed with a load of 60,000 pounds per square inch, causing a permanent set of ″.0937 in 5 inches. Rested 12 days and 18 hours, then stem was turned down from 1.″0092 to .″973 diameter for the purpose of straightening, and tested by tension.

Sectional area, .7436 square inch.

Gauged length, 5″.

Tension loads were applied up to 70,000 pounds per square inch, causing a permanent set of ″.1570. Bar rested 18 months and tension test resumed.

[See Report, 1889, page 410 for previous test.]

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
744	1,000	0.	.1570	Micrometer reset to the last observed set.
7,436	10,000	.1587	.....	
14,872	20,000	.1605	.....	
22,308	30,000	.1623	.....	
29,744	40,000	.1641	.....	
37,180	50,000	.1660	.....	
44,616	60,000	.1678	.....	
37,180	50,000	.1660	.....	
29,744	40,000	.1642	.....	
22,308	30,000	.1623	.....	
14,872	20,000	.1604	.....	
7,436	10,000	.1585	.1570	
44,616	60,000	.1678	.....	
48,334	65,000	.1687	.....	
50,565	68,000	.1692	.....	
51,308	69,000	.1694	.....	
52,052	70,000	.1696	.1570	
52,795	71,000	.1699	.....	
53,539	72,000	.1700	.....	
54,282	73,000	.1701	.....	
55,026	74,000	.1704	.....	
55,770	75,000	.1705	.....	
52,052	70,000	.1697	.....	
44,616	60,000	.1679	.....	
37,180	50,000	.1660	.....	
29,744	40,000	.1642	.....	
22,308	30,000	.1623	.....	
14,872	20,000	.1604	.....	
7,436	10,000	.1585	.1569	
55,026	74,000	.1703	.....	Sustained load one half hour with no change in elongation.
44,616	60,000	.1678	.....	Load left on specimen over night.
34,210	46,000	.....	.....	Load on specimen in morning after 15 hours.
44,616	60,000	.1678	.....	
55,026	74,000	.1703	.....	
55,770	75,000	.1705	.....	
56,514	76,000	.1707	.....	
57,257	77,000	.1708	.....	
58,001	78,000	.1711	.....	
58,744	79,000	.1712	.....	
59,488	80,000	.1714	.....	
52,052	70,000	.1696	.....	
44,616	60,000	.1678	.....	
37,180	50,000	.1660	.....	
29,744	40,000	.1641	.....	
22,308	30,000	.1623	.....	
14,872	20,000	.1603	.....	
7,436	10,000	.1585	.1569	
7,436	10,000	.1585	.....	
14,872	20,000	.1603	.....	
22,308	30,000	.1622	.....	
29,744	40,000	.1640	.....	
37,180	50,000	.1659	.....	
44,616	60,000	.1677	.....	
52,052	70,000	.1695	.....	
59,488	80,000	.1713	.....	

No. 3344*a*—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
.....	.....	.1714	.....	After 10 minutes.
.....	.....	.1714	.....	After 15 minutes.
60,232	81,000	.1716	.....	
60,975	82,000	.1718	.....	
61.719	83,000	.1720	.....	
59,488	80,000	.1715	.....	
52,052	70,000	.1697	.....	
44,616	60,000	.1678	.....	
37,180	50,000	.1661	.....	
29,744	40,000	.1642	.....	
22,308	30,000	.1623	.....	
14,872	20,000	.1604	.....	
7,436	10,000	.1585	.1570	
7,436	10,000	.1585	.....	
14,872	20,000	.1603	.....	
22,308	30,000	.1623	.....	
29,744	40,000	.1642	.....	
37,180	50,000	.1660	.....	
44,616	60,000	.1678	.....	
52,052	70,000	.1696	.....	
59,488	80,000	.1715	.....	
61,719	83,000	.1720	.....	Elastic limit.
.....	83,000	.1722	.....	After 2 minutes.
.....	83,000	.1730	.....	After 5 minutes.
.....	83,000	.2575	.....	After 8 minutes.
.....	83,000	.2615	.....	After 10 minutes.
59,488	80,000	.2610	.....	
52,052	70,000	.2592	.....	
44,616	60,000	.2572	.....	
37,180	50,000	.2550	.....	
29,744	40,000	.2527	.....	
22,308	30,000	.2505	.....	
14,872	20,000	.2481	.....	
7,436	10,000	.2456	.2432	
7,436	10,000	.2447	.....	
14,872	20,000	.2468	.....	
22,308	30,000	.2490	.....	
29,744	40,000	.2510	.....	
37,180	50,000	.2532	.....	
44,616	60,000	.2564	.....	
52,052	70,000	.2580	.....	
59,488	80,000	.2610	.....	
52,052	70,000	.2591	.....	
59,488	80,000	.2610	.....	
52,052	70,000	.2592	.....	
44,616	60,000	.2572	.2437	No change after 5 minutes.

Specimen rested without load 35 days then test resumed under compression stresses.

Sectional area called .7436 square inch, as in the preceding test.

Gauged length, 5″.2437.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
744	1,000	0.	0.	Initial load.
3,718	5,000	.0008	0.	
7,436	10,000	.0018	0.	
11,154	15,000	.0027	0.	
14,872	20,000	.0037	0.	
18,590	25,000	.0046	.0003	
19,334	26,000	.0048	.....	
20,077	27,000	.0050	.....	
20,821	28,000	.0053	.....	
21,565	29,000	.0055	.....	
22,308	30,000	.0057	.0005	
23,052	31,000	.0060	.....	
23,795	32,000	.0063	.....	
24,539	33,000	.0066	.....	
25,282	34,000	.0071	.....	
26,026	35,000	.0074	.0012	
26,770	36,000	.0079	.....	
27,513	37,000	.0083	.....	
28,257	38,000	.0089	.....	
29,000	39,000	.0096	.....	
29,744	40,000	.0101	.0029	
30,488	41,000	.0108	.....	
31,231	42,000	.0113	.....	
31,975	43,000	.0121	.....	
32,718	44,000	.0129	.....	
33,462	45,000	.0142	.0059	
34,206	46,000	.0155	.....	
34,949	47,000	.0166	.....	
35,693	48,000	.0178	.....	
36,436	49,000	.0193	.....	
37,180	50,000	.0215	.0123	

Compression test discontinued.
Stem turned down to ″.714 diameter and test resumed under tension stresses.
Interval between tests, 22 hours.
Sectional area, .40 square inch.
New gauged length of 5″ established.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0005	0.	
4,000	10,000	.0015	.....	
6,000	15,000	.0024	0.	
8,000	20,000	.0032	.....	
10,000	25,000	.0040	0.	
12,000	30,000	.0049	.....	
14,000	35,000	.0058	0.	
16,000	40,000	.0069	.0001	
18,000	45,000	.0079	.0002	
20,000	50,000	.0091	.0004	
20,400	51,000	.0093	.....	
20,800	52,000	.0096	.....	
21,200	53,000	.0099	.....	
21,600	54,000	.0102	.....	
22,000	55,000	.0104	.0009	
22,400	56,000	.0108	.....	
22,800	57,000	.0111	.....	
23,200	58,000	.0114	.....	
23,600	59,000	.0117	.....	
24,000	60,000	.0120	.0015	
24,400	61,000	.0123	.....	
24,800	62,000	.0126	.....	
25,200	63,000	.0129	.....	
25,600	64,000	.0132	.....	
26,000	65,000	.0136	.0022	
26,400	66,000	.0141	.....	
27,200	68,000	.0149	.....	
28,000	70,000	.0159	.0033	
28,800	72,000	.0168	.....	
29,600	74,000	.0178	.....	
30,400	76,000	.0190	.....	
31,200	78,000	.0203	.....	
32,000	80,000	.0217	.0071	
32,800	82,000	.0231	.....	
33,600	84,000	.0246	.....	
34,400	86,000	.0271	.....	
35,200	88,000	.0283	.....	
36,000	90,000	.0313	.0141	
36,800	92,000	.0385	.....	
37,600	94,000	.1215	.....	
38,400	96,000	.20	.....	
38,900	97,250	.31	.....	Tensile strength.
31,800	.....	.....	.....	At time of rupture.
0	0	.70	.....	=14.0 per cent.

Elongation of inch sections: ″.07, ″.07, ″.07, ″.23, ″.26*.
Diameter at fracture, ″.52; area, .212 square inch.
Contraction of area, 47.0 per cent.
Fractured 1″.9 from the neck. Appearance, fine silky.

No. 3447*a*.

Mark 4.

Initially compressed under 60,000 pounds per square inch, causing a permanent set of ″.0763 in 5 inches.

Rested 19 months, stem then turned down from 1″.0092 to ″.969 diameter for the purpose of straightening, and tested by tension.

Sectional area, .737 square inch.

New gauged length of 5″ established.

[See Report, 1889, page 413, for compression test.]

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
737	1,000	0.	0.	Initial load.
3,685	5,000	.0006	0.	
7,370	10,000	.0015	0.	Threaded ends not straightened.
11,055	15,000	.0021	—.0001	
14,740	20,000	.0031	—.0002	
18,425	25,000	.0040	—.0002	
22,110	30,000	.0048	—.0003	
25,795	35,000	.0056	—.0006	
29,480	40,000	.0065	—.0004	
30,217	41,000	.0066	.....	
30,954	42,000	.0067	.....	
31,691	43,000	.0069	.....	
32,428	44,000	.0071	.....	
33,165	45,000	.0073	—.0004	
33,902	46,000	.0076	.....	
34,639	47,000	.0077	.....	
35,376	48,000	.0079	.....	Elastic limit.
36,113	49,000	.0355	.....	
36,850	50,000	.0384	.0290	
38,324	52,000	.0458	.....	
39,798	54,000	.0553	.....	
41,272	56,000	.0640	.....	
42,746	58,000	.0752	.....	
44,220	60,000	.0868	.0749	

Rested without load 15 days, test then resumed under compression loads.

Gauged length, 5″.0749.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
737	1,000	0.	0.	Initial load.
3,685	5,000	.0005	0.	
7,370	10,000	.0014	0.	
11,055	15,000	.0023	0.	
14,740	20,000	.0032	0.	
18,425	25,000	.0040	.0001	
22,110	30,000	.0050	.0004	
29,480	40,000	.0092	.0025	Elastic limit below 40,000 pounds per square inch.
30,217	41,000	.0095	.....	
30,954	42,000	.0103	.....	
31,691	43,000	.0110	.....	
32,428	44,000	.0118	.....	
33,165	45,000	.0129	.0053	
33,902	46,000	.0142	.....	
34,639	47,000	.0154	.....	
35,376	48,000	.0167	.....	
36,113	49,000	.0173	.....	
36,850	50,000	.0185	.0100	
38,324	52,000	.0220	.....	
39,798	54,000	.0255	.....	
41,272	56,000	.0290	.....	
42,746	58,000	.0340	.....	
44,220	60,000	.0385	.0280	

Compression test discontinued.

Specimen turned down to ″.918 diameter, and test resumed under tension loads.

Interval between tests, 24 hours.

Sectional area, .662 square inch.

New gauged length of 5″ established

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
662	1,000	0.	0.	Initial load.
3,310	5,000	.0007	0.	
6,620	10,000	.0016	0.	
9,930	15,000	.0025	0.	
13,240	20,000	.0035	.0001	
16,550	25,000	.0048	.0005	
19,860	30,000	.0068	.0015	
20,522	31,000	.0073	.....	
21,184	32,000	.0077	.....	
21,846	33,000	.0082	.....	
22,508	34,000	.0088	.....	
23,170	35,000	.0094	.0031	
23,832	36,000	.0100	.....	
24,494	37,000	.0105	.....	
25,156	38,000	.0110	.....	
25,818	39,000	.0115	.....	
26,480	40,000	.0123	.0050	
		Rested 16 hours under 1,000 pounds per square inch.		
27,142	41,000	.0130	.....	
27,804	42,000	.0133	.....	
26,466	43,000	.0137	.....	
29,128	44,000	.0142	.....	
29,790	45,000	.0151	.0069	
30,452	46,000	.0160	.....	
31,114	47,000	.0170	.....	
31,776	48,000	.0179	.....	
32,438	49,000	.0186	.....	
33,100	50,000	.0205	.0112	
33,762	51,000	.0214	.....	
34,424	52,000	.0225	.....	
35,086	53,000	.0237	.....	
35,748	54,000	.0252	.....	
36,410	55,000	.0263	.0162	
37,072	56,000	.0284	.....	
37,734	57,000	.0294	.....	
38,396	58,000	.0313	.....	
39,058	59,000	.0330	.....	
39,720	60,000	.0358	.0245	
41,044	62,000	.0407	.....	
42,368	64,000	.0486	.....	
43,692	66,000	.0602	.....	
45,016	68,000	.0730	.....	
46,340	70,000	.0890	.0748	
47,664	72,000	.1038	.....	
48,988	74,000	.1256	.1102	

Rested 2 days, then heated a dull red color; cooled in the open air, then turned down to ″.714 diameter and test by tension resumed until bar ruptured.

Sectional area, .40 square inch.

New gauged length of 5″ established.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0008	.....	
4,000	10,000	.0016	.....	
8,000	20,000	.0034	.....	
12,000	30,000	.0053	.....	
16,000	40,000	.0070	.0001	
20,000	50,000	.0089	.0002	
22,000	55,000	.0099	.0003	
24,000	60,000	.0107	.0003	
26,000	65,000	.0117	.0003	
27,200	68,000	.0122	.....	
27,600	69,000	.0124	.....	
27,800	69,500	.....	.....	Elastic limit. Momentarily sustained then load fell.
25,200	63,000	.0865	.....	
25,600	64,000	0920	.....	
26,000	65,000	.0967	.....	
26,400	66,000	.1045	.....	
26,800	67,000	.1128	.....	
27,200	68,000	.1217	.....	
27,600	69,000	.1288	.....	
28,000	70,000	.1425	.1270	
28,400	71,000	.1480	.....	
28,800	72,000	.1515	.....	
29,600	74,000	.1830	.....	
30,400	76,000	.2100	.....	
31,200	78,000	.25	.....	
32,000	80,000	.29	.....	
32,800	82,000	.32	.....	
33,600	84,000	.41	.....	
34,400	86,000	.52	.....	
34,640	86,600	.67	.....	Tensile strength.
30,000	.....	.....	.....	At time of rupture.
.....	.....	.94	.....	=18.8 per cent.

Elongation of inch sections: ″.10, ″.19, ″.42,* ″.13, ″.10.
Diameter at fracture: ″.51; area, .204 square inch.
Contraction of area, 49 per cent.
Fractured at middle of stem. Appearance, fine silky.

No. 3348*a*.

Mark 4.

Initially compressed under 59,000 pounds per square inch, causing a permanent set of ″.0840 in 5 inches.

Rested 19 months, stem then turned down from 1″.0092 to ″.983 diameter for the purpose of straightening, and tested by tension.

Sectional area, .759 square inch.

New gauged length of 5″ established.

[See Report, 1889, page 414, for compression test.]

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
759	1,000	0.	0.	Initial load.
3,795	5,000	.0008	0.	
7,590	10,000	.0017	0.	Threaded ends not straightened.
11,385	15,000	.0025	—.0001	
15,180	20,000	.0034	—.0001	
18,975	25,000	.0042	0.	
22,770	30,000	.0052	0.	
26,565	35,000	.0061	+.0001	
30,360	40,000	.0070	.0001	
31,119	41,000	.0072	.....	
31,878	42,000	.0073	.....	
32,637	43,000	.0075	.....	
33,396	44,000	.0077	.....	
34,155	45,000	.0079	.0001	
34,914	46,000	.0082	.....	
35,673	47,000	.0084	.....	
36,432	48,000	.0087 / .0320	.....	Elastic limit.
37,191	49,000	.0343	.....	
37,950	50,000	.0373	.0279	
39,468	52,000	.0459	.....	
40,986	54,000	.0540	.....	
42,504	56,000	.0649	.....	
44,022	58,000	.0764	.....	
45,540	60,000	.0892	.0772	

Rested without load 15 days, then test resumed under compression stresses.

Gauged length, 5″.0772.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
759	1,000	0.	0.	Initial load.
3,795	5,000	.0006	.....	
7,590	10,000	.0015	.....	
15,180	20,000	.0031	0.	
22,770	30,000	.0052	.0003	
23,529	31,000	.0056	.....	
24,288	32,000	.0059	.....	
25,047	33,000	.0064	.....	
25,806	34,000	.0069	.....	
26,563	35,000	.0073	.0015	
27,324	36,000	.0079	.....	
28,083	37,000	.0083	.....	
28,842	38,000	.0090	.....	
29,601	39,000	.0095	.....	
30,360	40,000	.0102	.0035	
31,119	41,000	.0111	.....	
31,878	42,000	.0118	.....	
32,637	43,000	.0120	.....	
33,396	44,000	.0133	.....	
34,155	45,000	.0148	.0070	Rested 15 hours under 30,000 lbs. per square inch.
34,914	46,000	.0152	.....	
35,673	47,000	.0157	.....	
36,432	48,000	.0173	.....	
37,191	49,000	.0195	.....	
37,950	50,000	.0210	.0123	
39,468	52,000	.0251	.....	
40,986	54,000	.0291	.....	
42,504	56,000	.0340	.....	
44,022	58,000	.0402	.....	
45,540	60,000	.0470	.0353	

Specimen rested without load 2 days, then turned down to ″.714 diameter, and tested by tension.
Sectional area, .40 square inch.
New gauged length of 5″ established.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0007	0.	
4,000	10,000	.0016	0.	
6,000	15,000	.0024	0.	
8,000	20,000	.0033	0.	
10,000	25,000	.0042	0.	
12,000	30,000	.0051	0.	
14,000	35,000	.0061	.0001	
16,000	40,000	.0072	.0004	
18,000	45,000	.0098	.0019	
18,400	46,000	.0104	.....	
18,800	47,000	.0108	.....	
19,200	48,000	.0113	.....	
19,600	49,000	.0122	.....	
20,000	50,000	.0131	.0044	
20,400	51,000	.0141	.....	
20,800	52,000	.0151	.....	
21,200	53,000	.0160	.....	
21,600	54,000	.0169	.....	
22,000	55,000	.0184	.0088	
22,400	56,000	.0201	.....	
22,800	57,000	.0215	.....	
23,200	58,000	.0233	.....	
23,600	59,000	.0248	.....	
24,000	60,000	.0280	.0170	
24,400	61,000	.0304	.....	
24,800	62,000	.0328	.....	
25,200	63,000	.0353	.....	
25,600	64,000	.0400	.....	
26,000	65,000	.0445	.0319	
26,400	66,000	.0500	.....	
26,800	67,000	.0553	.....	
27,200	68,000	.0643	.....	
27,600	69,000	.0730	.....	
28,000	70,000	.0830	.0690	
28,400	71,000	.0880	.....	
28,800	72,000	.0958	.....	
29,200	73,000	.1073	.....	
29,600	74,000	.1164	.....	
30,000	75,000	.1260	.1104	
30,400	76,000	.1351	.....	
30,800	77,000	.1475	.....	
31,200	78,000	.1615	.....	
31,600	79,000	.18	.....	
32,000	80,000	.195	.....	
32,400	81,000	.21	.....	
32,800	82,000	..225	.....	
33,200	83,000	.25	.....	
33,600	84,000	.28	.....	
34,000	85,000	.31	.....	
34,400	86,000	.36	.....	
34,800	87,000	.42	.....	
35,200	88,000	.52	.....	
35,440	88,600	.66	.....	Tensile strength.
28,600	.....	.....	.....	At time of rupture.
0	0	1.05	.....	=21.0 per cent.

Elongation of inch sections. ′.18, ′.46*, ″.15, ″.13, ″.13.
Diameter at fracture, ″.50; area, .196 square inch.
Contraction of area, 51 per cent.
Fractured 2″.1 from the neck. Appearance, fine silky

No. 3349*a*.

Mark 4.

Initially compressed under 59,000 pounds per square inch, causing a permanent set of ″.0814 in 5 inches.

Rested 19 months, after which the stem was turned down from 1″.0092 to ″.959 diameter for the purpose of straightening, and tested by tension.

Sectional area, .722 square inch.

Gauged length, 5″.

[See Report, 1889, page 415, for compression test.]

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
722	1,000	0.	0.	Initial load.
3,610	5,000	.0008	0.	
7,220	10,000	.0015	0.	
10,830	15,000	.0023	0.	
14,440	20,000	.0031	0.	
18,050	25,000	.0040	0.	
21,660	30,000	.0050	0.	
25,270	35,000	.0060	.0002	
28,880	40,000	.0070	.0002	
32,490	45,000	.0080	.0004	
33,212	46,000	.0083	.....	Elastic limit.
33,934	47,000	.0298	.....	
34,656	48,000	.0324	.....	
35,378	49,000	.0356	.....	
36,100	50,000	.0396	.0305	
37,544	52,000	.0464	.....	
38,988	54,000	.0557	.....	
40,432	56,000	.0670	.....	
41,876	58,000	.0764	.....	
43,320	60,000	.0886	.0770	

Rested 2 months and 20 days, then loaded alternately with tensile stress of 70,000 pounds per square inch and compression stress of 50,000 pounds per square inch, the stress in each direction being applied 20 times; the last application was in the compression direction.

Permanent set, ″.14 elongation, which includes ″.0770 of preceding experiment.

Specimen next turned down to ″.798 diameter and tested by tension.

Sectional area, .50 square inch.

Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	.0001	
5,000	10,000	.0016	.0001	
7,500	15,000	.0024	.0001	
10,000	20,000	.0033	.0001	
12,500	25,000	.0042	.0001	
15,000	30,000	.0052	.0001	
20,000	40,000	.0073	.0004	
22,500	45,000	.0084	.0008	
25,000	50,000	.0102	.0016	
25,500	51,000	.0107	.....	
26,000	52,000	.0111	.....	
26,500	53,000	.0118	.....	
27,000	54,000	.0123	.....	
27,500	55,000	.0130	.0033	
28,000	56,000	.0137	.....	
28,500	57,000	.0143	.....	
29,000	58,000	.0151	.....	
29,500	59,000	.0160	.....	
30,000	60,000	.0170	.0063	
30,500	61,000	.0184	.....	
31,000	62,000	.0195	.....	
31,500	63,000	.0205	.....	
32,000	64,000	.0221	.....	
32,500	65,000	.0235	.0115	
33,000	66,000	.0257	.....	
33,500	67,000	.0267	.....	
34,000	68,000	.0284	.....	
34,500	69,000	.0303	.....	
35,000	70,000	.0333	.0199	
35,500	71,000	.0361	.....	
36,000	72,000	.0375	.....	
36,500	73,000	.0399	.....	
37,000	74,000	.0443	.....	
37,500	75,000	.0507	.0358	
38,000	76,000	.06	.....	
39,000	78,000	.08	.....	
40,000	80,000	.10	.....	
41,000	82,000	.125	.....	
42,000	84,000	.16	.....	
43,000	86,000	.20	.....	
44,000	88,000	.27	.....	
45,000	90,000	.40	.....	
45,760	91,520	.63	.....	Tensile strength.
37,800	.....	.....	.....	At time of rupture.
0	0	1.00	.....	=20.0 per cent.

Elongation of inch sections, ″.13, ″.14, ″.21, ″.39*, ″.13.
Diameter at fracture, ″.57; area, .255 square inch.
Contraction of area, 49 per cent.
Fractured 2″.75 from the neck. Appearance, fine silky.

No. 3352*a*.

Mark 4.

This specimen was initially compressed with 59,000 pounds per square inch, causing a permanent set of ″.04 in 5 inches. Rested 19 months, then recompressed with 65,000 pounds per square inch, after which the stem was turned down from 1″.0092 to ″.714 diameter for the purpose of straightening, and test resumed under tensile stresses, after a further rest of 18 days.

Sectional area, .40 square inch.

New gauged length of 5″ established.

[See Report, 1889, page 416, for compression test.]

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0006	0.	
4,000	10,000	.0014	.....	
6,000	15,000	.0023	.....	
8,000	20,000	.0031	0.	
10,000	25,000	.0040	.....	
12,000	30,000	.0050	0.	
14,000	35,000	.0060	.....	
16,000	40,000	.0072	.0004	
16,400	41,000	.0074	.....	
16,800	42,000	.0076	.....	
17,200	43,000	.0078	.....	
17,600	44,000	.0081	.....	
18,000	45,000	.0088	.0013	
18,400	46,000	.0304	.....	
18,800	47,000	.0326	.....	
19,200	48,000	.0351	.....	
19,600	49,000	.0392	.....	
20,000	50,000	.0443	.0349	
20,400	51,000	.0479	.....	
20,800	52,000	.0506	.....	
21,200	53,000	.0569	.....	
21,600	54,000	.0619	.....	
22,000	55,000	.0663	.0556	
22,400	56,000	.0712	.....	
22,800	57,000	.0757	.....	
23,200	58,000	.0820	.....	
23,600	59,000	.0882	.....	
24,000	60,000	.0933	.0807	
24,400	61,000	.0985	.....	
24,800	62,000	.1064	.....	
25,200	63,000	.1134	.....	
25,600	64,000	.1204	.....	
26,000	65,000	.1290	.1158	
26,400	66,000	.1349	.....	
26,800	67,000	.1418	.....	
27,200	68,000	.1527	.....	
27,600	69,000	.1612	.....	
28,000	70,000	.1724	.1575	
28,400	71,000	.1777	.....	
28,800	72,000	.1847	.....	
29,200	73,000	.1993	.....	
29,600	74,000	.2112	.....	
30,000	75,000	.22	.....	
30,400	76,000	.24	.....	
30,800	77,000	.26	.....	
31,200	78,000	.28	.....	
31,600	79,000	.29	.....	
32,000	80,000	.31	.....	
32,400	81,000	.33	.....	
32,800	82,000	.36	.....	
33,200	83,000	.39	.....	
33,600	84,000	.42	.....	

No. 3352*a*—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
34,000	85,000	.49	.....	
34,400	86,000	.56	.....	
34,800	87,000	.70	.....	
34,820	87,050	.86	.....	Tensile strength.
29,100	.....	.....	.....	At time of rupture.
0	0	1.19	.....	=23.8 per cent.

Elongation of inch sections: ″15, ″.22, ″.47*, ″.18, ″.17.
Diameter at fracture, ″.51; area, .204 square inch.
Contraction of area, 49.0 per cent.
Fractured 3″.35 from the neck. Appearance, fine silky.

No. 3353*a*.

Mark 4.

Initially compressed under 61,000 pounds per square inch, causing a permanent set of ″.0730 in 5 inches.

When mounted on centers the stem runs out of line ″.03½.

After resting 19 months, test resumed under tensile stresses. Same gauged length used as before, now measuring 4″.9270, setting micrometer, however, at zero under initial load.

Original sectional area, .80 square inch.

[See Report, 1889, page 417, for compression test.]

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	Initial load.
4,000	5,000	.0007	0.	
8,000	10,000	.0015	0.	
12,000	15,000	.0024	0.	
16,000	20,000	.0032	0.	
20,000	25,000	.0040	0.	
24,000	30,000	.0049	0.	
28,000	35,000	.0057	0.	
32,000	40,000	.0066	0.	
36,000	45,000	.0075	.0001	
36,800	46,000	.0077	.....	
37,600	47,000	.0079	.....	
38,400	48,000	.0082	.....	Elastic limit.
39,200	49,000	.0350.	.....	
40,000	50,000	.0382	.0291	
41,600	52,000	.0452	.....	
43,200	54,000	.0552	.....	
44,800	56,000	.0620	.....	
46,400	58,000	.0728	.....	
48,000	60,000	.0845	.0731	

Rested 2 months and 20 days; then alternate stresses applied; 70,000 pounds per square inch tension and 50,000 pounds per square inch compression.

The stress was applied 50 times in each direction; the last application was in a compression direction.

The total set after the above repeated stresses was ″.12, which was one of extension, and includes the set of ″.0731, which existed at the close of the preceding experiment.

Specimen now turned down to ″.798 diameter.

Sectional area, .50 square inch.

Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	0.	
5,000	10,000	.0016	0.	
7,500	15,000	.0025	0.	
10,000	20,000	.0033	0.	
12,500	25,000	.0043	.0001	
15,000	30,000	.0051	.0002	
17,500	35,000	.0060	.0002	
20,000	40,000	.0070	.0002	
22,500	45,000	.0080	.0003	
25,000	50,000	.0092	.0007	
25,500	51,000	.0095	----------	
26,000	52,000	.0099	----------	
26,500	53,000	.0103	----------	
27,000	54,000	.0107	----------	
27,500	55,000	.0113	.0019	
28,000	56,000	.0118	----------	
28,500	57,000	.0122	----------	
29,000	58,000	.0128	----------	
29,500	59,000	.0134	----------	
30,000	60,000	.0140	----------	
30,500	61,000	.0150	----------	
31,000	62,000	.0158	----------	
31,500	63,000	.0168	----------	
32,000	64,000	.0176	----------	
32,500	65,000	.0190	.0075	
33,000	66,000	.0207	----------	
33,500	67,000	.0219	----------	
34,000	68,000	.0233	----------	
34,500	69,000	.0249	----------	
35,000	70,000	.0273	.0144	
35,500	71,000	.0302	----------	
36,000	72,000	.0330	----------	
36,500	73,000	.0348	----------	
37,000	74,000	.0390	----------	
37,500	75,000	.0435	.0287	
38,000	76,000	.0486	----------	
38,500	77,000	.0531	----------	
39,000	78,000	.0590	----------	
39,500	79,000	.0720	----------	
40,000	80,000	.0860	.0692	
41,000	82,000	.11	----------	
42,000	84,000	.15	----------	
43,000	86,000	.19	----------	
44,000	88,000	.27	----------	
45,000	90,000	.37	----------	
45,620	91,240	.54	----------	Tensile strength.
38,000	----------	----------	----------	At time of rupture.
0	0	.95	----------	= 19.0 per cent.

Elongation of inch sections, ″.43*, ″.20, ″.11, ″.10. ″.11.
Diameter at fracture, ″.57; area, .255 square inch.
Contraction of area, 49.0 per cent.
Fractured 1″.60 from the neck. Appearance, fine silky.

No. 3354*c*.

Mark 4.

This specimen was previously strained with compression and tension loads of 59,000 and 67,000 pounds per square inch, respectively, causing a permanent tension set of ″.0884 in 5 inches, then loaded with 35,000 pounds per square inch compression, which reduced the permanent tension set to ″.0827. Light chips were taken over stem and threaded sections to straighten the specimen, and tested by tension 2½ hours after close of compression test.

Diameter of stem, ″.993.

Sectional area, .774 square inch.

New gauged length of 5″ established.

Tension loads applied up to 65,000 pounds per square inch, causing a permanent set of ″.0075. Bar rested 18 months, then turned down to ″.798 diameter, and test by tension resumed.

Sectional area, .50 square inch.

Gauged length, 5″.

[See Report, 1889, page 421, for earlier tests.]

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
500	1,000	0.	0.	Initial load.
5,000	10,000	.0017	.....	
10,000	20,000	.0034	.....	
15,000	30,000	.0052	.....	
20,000	40,000	.0070	.....	
25,000	50,000	.0087	0.	
30,000	60,000	.0104	.....	
32,500	65,000	.0113	0.	
33,000	66,000	.0115	.....	
33,500	67,000	.0117	.....	
34,000	68,000	.0118	.....	
34,500	69,000	.0120	.....	
35,000	70,000	.0122	0.	
35,500	71,000	.0124	.....	
36,000	72,000	.0126	.....	
36,500	73,000	.0128	.....	
37,000	74,000	.0130	.....	
37,500	75,000	.0132	0.	Elastic limit.
38,000	76,000	.0165	.....	
36,000	72,000	.0207	.....	
		.0312	.....	
36,500	73,000	.0755	.....	
37,000	74,000	.0853	.....	
37,500	75,000	.0965	.....	
38,000	76,000	.1053	.....	
38,500	77,000	.1130	.....	
39,000	78,000	.1235	.....	
39,500	79,000	.1391	.....	
40,000	80,000	.1525	.....	
40,500	81,000	.1620	.....	
41,000	82,000	.1785	.....	
42,000	84,000	.2125	.....	
43,000	86,000	.2725	.....	
44,000	88,000	.3325	.....	
45,000	90,000	.4225	.....	
45,560	91,120	.6625	.....	Tensile strength.
0	0	1.02	.....	= 20.4 per cent.

Elongation of inch sections: ″.12, ″.23, ″.40,* ″.15, ″.12.

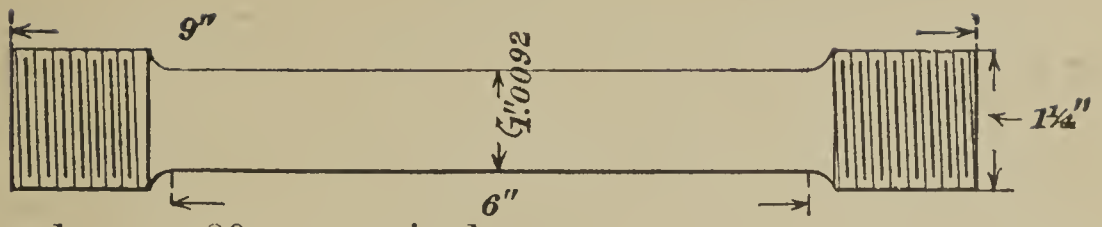
Diameter at fracture, ″.57; area, .255 square inch.

Contraction of area, 49.0 per cent.

Fractured 3″ from the neck. Appearance, fine, silky.

No. 5239.

MARK 4″.



Sectional area, .80 square inch.

Alternately loaded with tensile and compressive stresses.

65,000 pounds per square inch applied twenty times under compression and twenty-one times by tension; the initial and final load being a tensile stress.

While under tensile stress ample time was allowed the specimen to elongate nearly all the load would cause.

The intervals under the compression stress were 3 to 5 seconds each. The tendency to deflect, would, it was thought, have caused ultimate failure by lateral deflection had the maximum compression stress been prolonged.

Specimen has a perment set of extension ″.065, permanent deflection ″.05 in 6 inches.

Specimen turned down to ″.798 diameter = .50 square inch sectional area. Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	0.	
5,000	10,000	.0017	0.	
7,500	15,000	.0027	0.	
10,000	20,000	.0035	0.	
12,500	25,000	.0043	0.	
15,000	30,000	.0053	0.	
17,500	35,000	.0062	0.	
20,000	40,000	.0071	0.	
22,500	45,000	.0080	0.	
25,000	50,000	.0090	0.	
27,500	55,000	.0098	0.	
30,000	60,000	.0107	0.	
32,500	65,000	.0114	0.	
33,000	66,000	.0115	.....	
33,500	67,000	.0117	.....	
34,000	68,000	.0118	.....	
34,500	69,000	.0119	.....	
35,000	70,000	.0121	0.	Elastic limit.
35,500	71,000	.0125	.....	
36,000	72,000	.0135	.....	
36,500	73,000	.0153	.....	
37,000	74,000	.0229	.....	
37,500	75,000	.0482	.0330	
38,000	76,000	.0608	.....	
38,500	77,000	.0760	.....	
39,000	78,000	.0930	.....	
39,500	79,000	.1080	.....	
40,000	80,000	.1320	.1140	
40,500	81,000	.15	.....	
41,000	82,000	.18	.....	
41,500	83,000	.21	.....	
42,000	84,000	.24	.....	
42,500	85,000	.29	.....	
43,000	86,000	.34	.....	
44,000	88,000	.49	.....	
44,430	88,860	.77	.....	Tensile strength.
36,100	.....	.....	.....	At time of rupture.
0	0	1.14	.....	= 22.8 per cent.

Elongation of inch sections: ″.48*, ″.20, ″.15, ″.15, ″.16.

Diameter at fracture, ″.56; area, .246 square inch.

Contraction of area, 50.8 per cent.

Fractured 1″.45 from the neck. Appearance, fine silky.

No. 5240.

Mark 4.

Same form as No. 5239.

Overstrained with 65,000 pounds per square inch tensile stress, after which alternate stresses of tension and compression were applied of 50,000 pounds per square inch each.

The stress in each direction was applied seventy-five times, ending with a load in the compression direction.

At the close of the repeated loadings the specimen had a permanent set of extension of ″.04 in 5 inches and was deflected laterally ″.02 in length of 6 inches.

Specimen turned down to ″.798 diameter = .50 square inch sectional area. Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	Initial load.
2,500	5,000	.0007	0.	
5,000	10,000	.0015	0.	
7,500	15,000	.0023	0.	
10,000	20,000	.0031	0.	
12,500	25,000	.0040	0.	
15,000	30,000	.0048	0.	
17,500	35,000	.0058	0.	
20,000	40,000	.0071	.0005	
22,500	45,000	.0099	.0023	
23,000	46,000	.0108	.....	
23,500	47,000	.0115	.....	
24,000	48,000	.0125	.....	
24,500	49,000	.0136	.....	
25,000	50,000	.0147	.0060	
25,500	51,000	.0161	.....	
26,000	52,000	.0173	.....	
26,500	53,000	.0188	.....	
27,000	54,000	.0205	.....	
27,500	55,000	.0225	.0128	
28,000	56,000	.0252	.....	
28,500	57,000	.0274	.....	
29,000	58,000	.0302	.....	
29,500	59,000	.0350	.....	
30,000	60,000	.0393	.0282	
30,500	61,000	.0443	.....	
31,000	62,000	.0485	.....	
31,500	63,000	.0550	.....	
32,000	64,000	.0622	.....	
32,500	65,000	.0712	.0582	
33,000	66,000	.0770	.....	
33,500	67,000	.0829	.....	
34,000	68,000	.0882	.....	
34,500	69,000	.1015	.....	
35,000	70,000	.1103	.0956	
35,500	71,000	.12	.....	
36,000	72,000	.125	.....	
36,500	73,000	.14	.....	
37,000	74,000	.15	.....	
37,500	75,000	.16	.....	
38,000	76,000	.18	.....	
38,500	77,000	.20	.....	
39,000	78,000	.22	.....	
39,500	79,000	.235	.....	
40,000	80,000	.25	.....	
40,500	81,000	.28	.....	
41,000	82,000	.30	.....	
41,500	83,000	.33	.....	
42,000	84,000	.38	.....	
42,500	85,000	.43	.....	
43,000	86,000	.49	.....	
43,500	87,000	.56	.....	
44,000	88,000	.88	.....	Tensile strength.
36,300	.....	.....	.....	At time of rupture.
0	0	1.18	.....	=23.6 per cent.

Elongation of inch sections, ″.33, ″.39*, ″.17, ″.15, ″.14.
Diameter at fracture, ″.55; area, .238 square inch.
Contraction of area, 52.4 per cent.
Fractured 1″.85 from the neck. Appearance, fine silky.

No. 5550.

Mark 4.

Specimen, 9″ long, ends, $1\frac{1}{4}$″ diameter, stem, 6″ long by 1″.0092 diameter.

Initially compressed with 60,000 pounds per square inch, causing a permanent set of ″.0795 in 5″.

After resting 9 days stem turned down to ″.714 diameter and tested by tension.

Sectional area, .40 square inch.

Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0005	0.	
4,000	10,000	.0015	0.	
6,000	15,000	.0025	0.	
8,000	20,000	.0033	0.	
10,000	25,000	.0043	.0001	
12,000	30,000	.0070	.0021	Elastic limit about 29,000 pounds per square inch.
12,400	31,000	.0090	.....	
12,800	32,000	.0097	.....	
13,200	33,000	.0108	.....	
13,600	34,000	.0119	.....	
14,000	35,000	.0130	.0069	
14,400	36,000	.0144	.....	
14,800	37,000	.0160	.....	
15,200	38,000	.0173	.....	
15,600	39,000	.0190	.....	
16,000	40,000	.0209	.0138	
16,400	41,000	.0231	.....	
16,800	42,000	.0254	.....	
17,200	43,000	.0281	.....	
17,600	44,000	.0310	.....	
18,000	45,000	.0350	.0297	
18,400	46,000	.0377	.....	
18,800	47,000	.0411	.....	
19,200	48,000	.0455	.....	
19,600	49,000	.0488	.....	
20,000	50,000	.0541	.0446	
4,000	10,000	.0463	.....	
8,000	20,000	.0480	.....	
12,000	30,000	.0500	.....	
16,000	40,000	.0520	.....	
20,000	50,000	.0549	.....	
20,400	51,000	.0570	.....	
20,800	52,000	.0590	.....	
21,200	53,000	.0655	.....	
21,600	54,000	.0700	.....	
22,000	55,000	.0772	.0670	
22,400	56,000	.0815	.....	
22,800	57,000	.0877	.....	
23,200	58,000	.0933	.....	
23,600	59,000	.0995	.....	
24,000	60,000	.1073	.0963	
24,400	61,000	.1135	.....	
24,800	62,000	.1183	.....	
25,200	63,000	.1274	.....	
25,600	64,000	.1370	.....	
26,000	65.000	.1458	.1325	
26,400	66,000	.1528	.....	
26,800	67,000	.1636	.....	
27,200	68,000	.1713	.....	
27,600	69,000	.1794	.....	
28,000	70,000	.1950	.1800	
28,400	71,000	.205	.....	
28,800	72,000	.215	.....	
29,200	73,000	.23	.....	
29,600	74,000	.25	.....	
30,000	75,000	.27	.....	
30,400	76,000	.29	.....	
30,800	77,000	.30	.....	
31,200	78,000	.32	.....	
31,600	79,000	.35	.....	

No. 5550—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
32,000	80,000	.38	.....	
32,400	81,000	.41	.....	
32,800	82,000	.45	.....	
33,200	83,000	.50	.....	
33,600	84,000	.56	.....	
34,000	85,000	.62	.....	
34,400	86,000	.80	.....	
34,440	86,100	.92	.....	Tensile strength.
28,300	.....	.....	.....	At time of rupture.
0	0	1.37	.....	=27.4 per cent.

Elongations of inch sections: ″.19, ″.27, ″.52*, ″.21, ″.18.
Diameter at fracture, ″.48; area, .181 square inch.
Contraction of area, 54.7 per cent.
Fractured 3″.4 from the neck. Appearance, fine silky.

No. 5551.

Mark 4.

Same form as No. 5550.

Initially compressed with 60,000 pounds per square inch, causing a permanent set of ″.0785 in 5″.

After resting 9 days, stem turned down to ″.714 diameter, and tested by tension.

Sectional area, .40 square inch.

Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inches.*	
400	1,000	0.	0.	Initial load.
2,000	5,000	.0005	0.	
4,000	10,000	.0014	0.	
6,000	15,000	.0023	0.	
8,000	20,000	.0032	0.	
10,000	25,000	.0041	0.	
10,400	26,000	.0043	.....	
10,800	27,000	.0047	.....	
11,200	28,000	.0048	.....	
11,600	29,000	.0051	.....	
12,000	30,000	.0055	.0005	Elastic limit.
12,400	31,000	.0063	.....	
12,800	32,000	.0071	.....	
13,200	33,000	.0082	.....	
13,600	34,000	.0101	.....	
14,000	35,000	.0118	.0058	
		Rested under initial load 1 hour.		
14,400	36,000	.0130	.....	
14,800	37,000	.0141	.....	
15,200	38,000	.0150	.....	
15,600	39,000	.0163	.....	
16,000	40,000	.0183	.0113	
16,800	42,000	.0229	.....	
17,600	44,000	.0278	.....	
18,400	46,000	.0340	.....	
19,200	48,000	.0420	.....	
20,000	50,000	.0504	.0409	
20,800	52,000	.0589	.....	
21,600	54,000	.0691	.....	
22,400	56,000	.0802	.....	
23,200	58,000	.0917	.....	
24,000	60,000	.1049	.0930	
24,800	62,000	.1165	.....	
25,600	64,000	.1332	.....	
26,400	66,000	.1506	.....	
27,200	68,000	.1660	.....	
28,000	70,000	.1922	.1770	
28,800	72,000	.22	.....	
29,600	74,000	.25	.....	
30,400	76,000	.28	.....	
31,200	78,000	.31	.....	
32,000	80,000	.37	.....	
32,400	81,000	.39	.....	
32,800	82,000	.42	.....	
33,200	83,000	.49	.....	
33,600	84,000	.32	.....	
34,000	85,000	.64	.....	
34,400	86,000	.86	.....	Tensile strength.
28,600	.....	.....	.....	At time of rupture.
0	0	1.28	.....	=25.6 per cent.

Elongation of inch sections, ″.17, ″.21, ″.51, ″.21, ″.18.

Diameter at fracture, ″.50; area, .196 square inch.

Contraction of area, 51 per cent.

Fractured at the middle of stem. Appearance, fine silky.

No. 3345*b*.

Mark 9.

Initially compressed with 58,000 pounds per square inch, causing a permanent set of ″.0488 in 5 inches, stem then turned down from ″.798 to ″.7915 diameter for the purpose of straightening, then strained by tension up to 50,000 pounds per square inch, then compressed, 20 hours after, with 30,000 pounds per square inch.

Rested 19 months 8 days, then test resumed under compression stress.

Area assumed to remain at ″.492 square inch.

Gauged length, 5″.036.

[See Report, 1889, page 434, for earlier tests.]

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
492	1,000	0,	0.	Initial load.
4,920	10,000	.0015	----------	
9,840	20,000	.0033	0.	
12,300	25,000	.0040	----------	
14,760	30,000	.0049	0.	
15,252	31,000	.0050	----------	
15,744	32,000	.0052	----------	
16,236	33,000	.0054	----------	
16,728	34,000	.0056	----------	
17,220	35,000	.0058	0.	
19,680	40,000	.0066	0.	
22,140	45,000	.0074	0.	
22,632	46,000	.0075	----------	
23,124	47,000	.0077	----------	
23,616	48,000	.0079	----------	
24,108	49,000	.0081	----------	
24,600	50,000	.0082	0.	
25,092	51,000	.0085	----------	
25,584	52,000	.0087	0.	

Compression test discontinued; after a rest of 4 hours test of specimen resumed under the tensile stress.

Same gauged length as before used.

Applied loads.		In ganged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
492	1,000	0.	0.	
2,460	5,000	.0006	0.	
4,920	10,000	.0015	0.	
7,380	15,000	.0023	0.	
9,840	20,000	.0033	0.	
12,300	25,000	.0042	0.	
14,760	30,000	.0050	0.	
17,220	35,000	.0059	0.	
19,680	40,000	.0068	0.	
22,140	45,000	.0077	0.	
24,600	50,000	.0086	0.	
25,584	52,000	.0090	0.	
		Rested 26 hours without load.		
26,076	53,000	.0091	.....	
26,568	54,000	.0093	.....	
27,060	55,000	.0095	0.	
27,552	56,000	.0097	.....	
28,044	57,000	.0099	.....	
28,536	58,000	.0101	.....	
29,028	59,000	.0103	.....	
29,520	60,000	.0107	.0052	
30,012	61,000	.0109	.....	Elastic limit.
30,504	62,000	.0148	.....	
30,996	63,000	.0435	.....	
31,488	64,000	.0506	.....	
31,980	65,000	.0555	.0423	
32,472	66,000	.0597	.....	
32,964	67,000	.0650	.....	
33,456	68,000	.0700	.....	
33,948	69,000	.0793	.....	
34,440	70,000	.0833	.0685	
35,424	72,000	.0955	.....	
36,408	74,000	.1115	.....	
37,392	76,000	.1215	.....	
38,376	78,000	.1415	.....	
39,360	80,000	.1600	.1420	
40,344	82,000	.20	.....	
41,328	84,000	.23	.....	
42,312	86,000	.27	.....	
43,296	88,000	.30	.....	
44,280	90,000	.35	.....	
45,264	92,000	.42	.....	
46,248	94,000	.53	.....	
46,700	94,920	.70	.....	Tensile strength.
44,100	.....	.....	.....	At time of rupture.
0	0	.92	.....	=18.4 per cent in 5 inches.

Diameter at fracture, ″.64; area, .322 square inch.

Contraction of area, 34.6 per cent.

Fractured 1″.6 from the neck. Appearance, fine silky; 40 per cent of surface interspersed with fine granulation.

No. 3355.

Mark 9.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 5″.
Tension stresses applied up to 70,000 pounds per square inch, causing a permanent set of ″.1202.
Bar allowed to rest 18 months, then tension test resumed.

[See Report, 1889, page 435, for original test.]

Applied loads.		In gauged lengths.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	1,000	.....	.1202	Micrometer reset according to last observation of permanent set.
5,000	10,000	.1218	.....	
10,000	20,000	.1238	.....	
15,000	30,000	.1255	.....	
20,000	40,000	.1273	.....	
25,000	50,000	.1290	.....	
30,000	60,000	.1308	.....	
25,000	50,000	.1290	.....	
20,000	40,000	.1273	.....	
15,000	30,000	.1257	.....	
10,000	20,000	.1238	.....	
5,000	10,000	.1220	.1202	
30,000	60,000	.1308	.....	
35,000	70,000	.1326	.....	
30,000	60,000	.1309	.....	
35,000	70,000	.1326	.....	
35,500	71,000	.1329	.....	
36,000	72,000	.1330	.....	
36,500	73,000	.1332	.....	
37,000	74,000	.1335	.....	
37,500	75,000	.1336	.1203	
38,000	76,000	.1337	.....	
38,500	77,000	.1340	.....	
39,000	78,000	.1341	.....	
39,500	79,000	.1344	.....	
40,000	80,000	.1348	.1205	Elastic limit.
40,000	80,000	.1352	.....	
.....	80,000	.1360	.....	After 5 minutes.
.....	80,000	.1365	.....	After 10 minutes.
.....	80,000	.1368	.....	After 15 minutes.
.....	80,000	.1370	.1225	After 30 minutes.
40,000	80,000	.1372	.....	
40,500	81,000	.1376	.....	
41,000	82,000	.1628	.....	
40,500	81,000	.1642	.....	
.....	81,000	.1682	.....	After 2 minutes.
.....	81,000	.1715	.....	After 4 minutes.
.....	81,000	.1757	.....	After 6 minutes.
.....	81,000	.1860	.....	After 8 minutes.
.....	81,000	.1892	.....	After 10 minutes.
.....	81,000	.1899	.....	After 12 minutes.
41,000	82,000	.1913	.....	
41,500	83,000	.1973	.....	
42,000	84,000	.2110	.....	
42,500	85,000	.2285	.....	
.....	85,000	.2332	.....	After 5 minutes.
40,000	80,000	.2322	.....	
35,000	70,000	.2302	.....	
30,000	60,000	.2282	.....	
25,000	50,000	.2260	.....	
20,000	40,000	.2240	.....	
15,000	30,000	.2216	.....	
10,000	20,000	.2191	.....	
5,000	10,000	.2164	.2134	
5,000	10,000	.2150	.....	
10,000	20,000	.2170	.....	
15,000	30,000	.2192	.....	
20,000	40,000	.2213	.....	
25,000	50,000	.2235	.....	
30,000	60,000	.2258	.....	
25,000	50,000	.2240	.....	

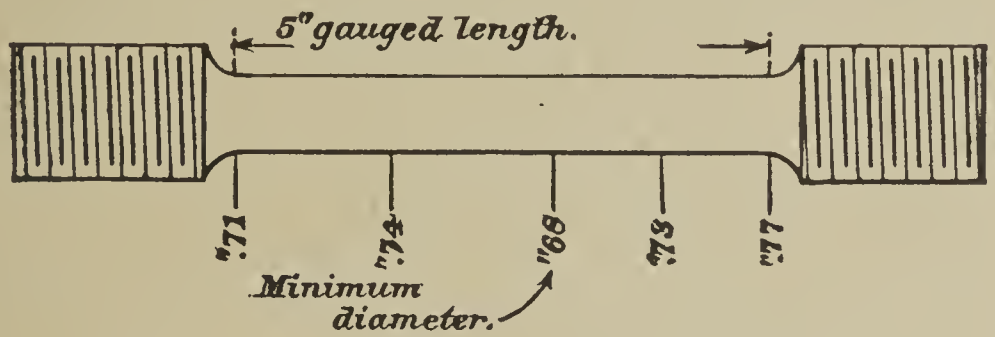
No. 3355—Continued.

Applied loads.		In gauged lengths.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
20,000	40,000	.2220	.....	
15,000	30,000	.2199	.....	
10,000	20,000	.2177	.....	
5,000	10,000	.2155	.2133	
42 500	85,000	.2345	.....	Micrometer removed.
44,000	88,000	.265	.....	
45,000	90,000	.30	.....	
46,000	92,000	.34	.....	
47,000	94,000	.40	.....	
48,000	96,000	.57	.....	
48,340	96,680	.78	.....	Tensile strength.
0	0	.88	.....	= 17.6 per cent.

Test discontinued before rupture of the bar was completed.

When the stress was released local contraction was going on rapidly under a total load of 45,000 pounds tension.

Measuring the specimen, the diameters were as follows:



Specimen turned down to ".672 uniform diameter and test resumed.

Present sectional area .355 square inch.

Tensile strength, 38,200 pounds =107,610 pounds per square inch on the area as turned down.

The specimen fractured at the neck, 3" from the place of greatest contraction before turning down. Appearance, silky, oblique.

Diameter at fracture, ".58; area, .264 square inch.

Contraction of area, 25.6 per cent.

TABLE SHOWING FINAL ELASTIC LIMITS, TENSILE STRENGTH, AND ELONGATIONS AFTER VARIOUS TREATMENTS AND ALSO WITHOUT TREATMENT.

STEEL BAR NO. 1.

No. of test.	Treatment.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 5 inches.
		Pounds.	*Pounds.*	*Per cent.*
5242	None	59,800	78,800	28.0
3346*a*	Compressed with 56,000 pounds per square inch. Rested 19 months then tested by tension	46,000	80,000	24.0

STEEL BAR NO. 4.

5548	None	61,000	86,000	26.4
5549	....do	59,000	86,200	24.0
5550	Compressed with load of 60,000 pounds per square inch, then rested 9 days	29,000	86,100	27.4
5551	....do	30,000	86,000	25.6
3343*a*	Compressed with 60,000 pounds per square inch, then loaded with 50,000 pounds per square inch tension, then, after resting 18 months, tension loads resumed and elastic limit found to be 64,550 pounds per square inch. Again compressed with 60,000 pounds per square inch, then ruptured by tension	.....	90,450	18.6
3344*a*	Compressed with 60,000 pounds per square inch, then loaded with 70,000 pounds per square inch tension, rested 18 months, then tension test resumed and elastic limit found to be 83,000 pounds per square inch; rested 35 days, then compressed with 50,000 pounds per square inch, then ruptured by tension	.....	97,250	14.0
3347*a*	Compressed with 60,000 pounds per square inch. Rested 19 months, then tested by tension, the elastic limit was 48,000 pounds per square inch. Loaded up to 60,000 pounds per square inch tension; rested 15 days, then loaded with 60,000 pounds per square inch compression, and with 74,000 pounds per square inch tension and, after heating a dull red color and cooling in the open air, test resumed by tension	69,500	86,600	18.8
3348*a*	Compressed with 59,000 pounds per square inch. Rested 10 months, then loaded up to 60,000 pounds per square inch tension. Elastic limit at this time is 48,000 pounds per square inch. Rested 15 days, then compressed with 60,000 pounds per square inch, and, after resting 2 days, test resumed by tension	.....	88,600	21.0
3349*a*	Compressed with 59,000 pounds per square inch. Rested 19 months, then loaded by tension up to 60,000 pounds per square inch. The elastic limit being 46,000 pounds per square inch. Rested 2 months and 20 days, then loaded alternately 20 times each with 70,000 pounds per square inch tension and 50,000 pounds per square inch compression. The last load being compression, then bar ruptured by tension	.....	91,520	20.0
3352*a*	Compressed with 59,000 pounds per square inch. Rested 19 months, then recompressed with 65,000 pounds per square inch, and afterward tested by tension.	.....	87,050	23.8
3353*a*	Compressed with 61,000 pounds per square inch. Rested 19 months, then loaded with 60,000 pounds per square inch tension, the elastic limit being 48,000 pounds per square inch. Rested 2 months and 20 days, then loaded alternately 50 times, each with 70,000 pounds per square inch tension, and 50,000 pounds per square inch compression, the last load being compression, and afterwards ruptured by tension	.....	91,240	19.0
3354*c*	Compressed with 59,000 pounds per square inch, then loaded with 67,000 pounds per square inch tension, afterwards loaded with 35,000 pounds per square inch compression, then with 65,000 pounds per square inch tension. Rested 18 months, then test resumed by tension	75,000	91,120	20.4

TABLE SHOWING FINAL ELASTIC LIMITS, STRENGTH, ETC.—Continued.

STEEL BAR NO. 4.—Continued.

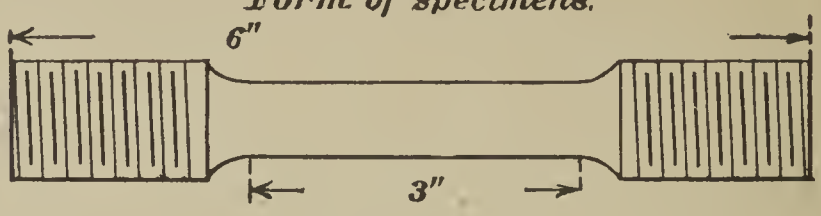
No. of test.	Treatment.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 5 inches.
		Pounds.	*Pounds.*	*Per cent.*
5239	Loaded alternately with 65,000 pounds per square inch tension and compression, twenty-one times by tension and twenty times compression, the initial and final load being tension. Bar then ruptured by tension	70,000	88,860	22.8
5240	Loaded with 65,000 pounds per square inch, tension then loaded alternately, 75 times each, with 50,000 pounds per square inch tension and compression, ending with a load of compression, and then tested by tension	.....	88,000	23.6
5241	None	59,000	86,820	27.0

STEEL BAR NO. 9.

4540	None	57,000	95,160	23.6
3345*b*	Compressed with 58,000 pounds per square inch. Rested 19 months 8 days, then tested by compression up to 52,000 pounds per square inch, and afterwards ruptured by tension	61,000	94,920	18.4
3355	Loaded with 70,000 pounds per square inch tension. Rested 18 months, then tension test resumed	80,000	96,680	17.6
	Test discontinued before rupture of the bar was completed, and stem turned down to ".672 uniform diameter, and test resumed	.....	107,610	.....

TENSILE TESTS OF STEEL REPRESENTING METAL IN FIXTURES FOR HYDROSTATIC TESTS OF HOOPS.

Form of specimens.



No. 5161.

Diameter, ″.564.
Sectional area, .25 square inch.
Elastic limit, 10,520 pounds = 42,080 pounds per square inch.
Tensile strength, 21,590 pounds = 86,360 pounds per square inch.
Elongation in 3 inches ″.65 = 21.7 per cent.
Elongation of inch sections: ″.14, ″.31*, ″.20.
Diameter at fracture, ″.45; area, .159 square inch.
Contraction of area, 36.4 per cent.
Fractured 1″.4 from the neck. Appearance, silky.

No. 4904.

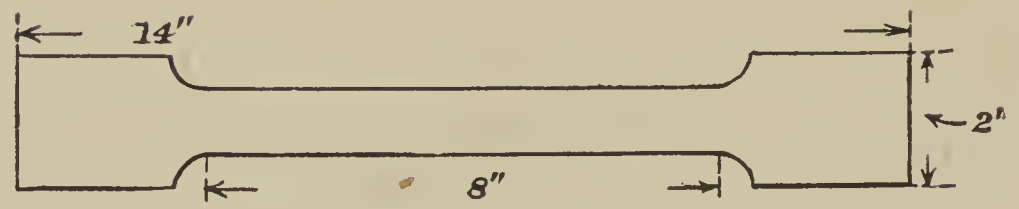
Diameter, ″.505.
Sectional area, .20 square inch.
Elastic limit, 9,440 pounds = 47,200 pounds per square inch
Tensile strength, 16,560 pounds = 82,800 pounds per square inch.
Elongation in 2 inches, ″.41 = 20.5 per cent.
Elongation of inch sections: ″.20, ″.21*.
Diameter at fracture, ″.40; area, .1257 square inch.
Contraction of area, 37.1 per cent.
Fractured at middle of stem. Appearance, silky, irregular surface.

TENSILE TESTS OF STEEL PLATES REPRESENTING METAL FOR WATERTOWN ARSENAL BOILERS.

SPECIMENS HAVE PLANED EDGES.

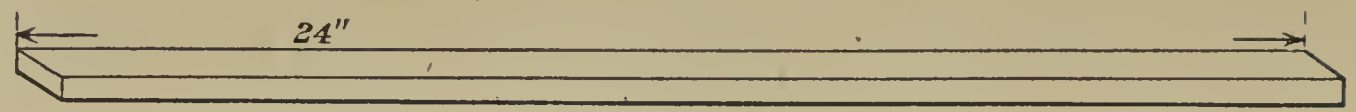
No. of test.	Mark on specimen.	Dimensions in inches.		Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.
		Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.					
		Inches.	*Inch.*	*Sq. inch.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Per ct.*	" " *Sq. in.*	*Per cent.*	
4866	1	1.49	.384	.572	22,250	38,900	35,980	62,900	1.87	23.4	1.14×.25=.285	50.2	Silky.
4867	2	1.49	.406	.605	21,300	35,210	33,740	55,770	2.30	28.7	1.06×.22=.233	61.5	Do.
4868	3	1.49	.401	.597	20,950	35,090	33,190	55,590	2.16	27.0	1.09×.25=.272	54.4	Do.
4869	4	1.48	.381	.564	20,100	35,640	30,920	54,820	1.88	23.5	1.10×.24=.264	53.2	Do.
4870	5	1.49	.396	.590	21,400	36,270	33,410	56,630	2.23	27.9	1.09×.23=.251	57.4	Do.
4871	6	1.48	.406	.601	21,200	35,270	33,870	56,360	2.14	26.7	1.07×.24=.256	57.4	Do.

STEEL PLATE FROM WATERVLIET ARSENAL.



No. of test.	Mark on specimen.	Dimensions in inches.		Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of 1-inch sections.
		Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.						
		Inches.	*Inch.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Per ct.*	" " *Sq. in.*	*Per ct.*		" " " " " " " "
6889	1	.973	.395	.384	14,740	38,390	22,510	58,620	1.80	22.5	.68×.24=.163	57.6	Silky, lamellar	.12, .16, .25, .58*, .18, .19, .18, .14
6890	2	.962	.379	.364	15,200	41,760	21,410	58,820	1.83	22.9	.67×.23=.154	57.7	....do	.12, .18, .19, .22, .59*, .23, .17, .13
6891	3	.963	.382	.368	12,730	34,590	20,160	54,780	2.00	25.0	.64×.21=.134	63.6	....do	.13, .17, .19, .25, .39, .56*, .19, .12
6892	4	.968	.442	.428	15,850	37,030	25,890	60,490	2.28	28.5	.63×.26=.164	61.7	....do	.21, .67*, .24, .25, .30, .25, .21, .15
6893	5	.969	.434	.421	16,380	38,910	25,880	61,470	2.00	25.0	.66×.24=.158	62.5	....do	.20, .49*, .44*, .24, .21, .15, .16, .11
6894	6	.968	.438	.424	15,120	35,660	23,840	56,230	1.57	19.6	.62×.22=.136	67.9	....do	.30, .59*, .19, .14, .11, .09, .08, .07
6895	7	.969	.452	.438	16,400	37,440	23,450	53,540	1.99	24.9	.65×.23=.149	66.0	....do	.13 .19, .20, .27, .68*, .23, .17, .12
6896	8	.962	.448	.431	15,750	36,540	26,420	61.300	2.19	27.4	.66×.25=.165	61.7	....do	.14, .22, .24, .36, .60*, .24, .21, .18
6897	9	.971	.450	.437	15,600	35,700	25,510	58,380	2.11	26.4	.62×.33=.205	53.1	....do	.18, .27, .69*, .26, .22, .20, .16, .13
6898	10	.962	.448	.431	15,750	36,540	25,100	58,240	2.04	25.5	.64×.25=.160	62.9	....do	.18. .23, .68*, .28, .19, .17, .17, .14
6899	11	.959	.451	.432	16,100	37,270	26,300	60,880	2.15	26.9	.64×.24=.154	64.3	....do	.15, .23, .35, .63*, .25, .21, .18, .15
6900	12	.969	.448	.434	17,180	39,590	26,200	60.370	1.93	24.1	.71×.27=.192	55.8	....do	.21, .58*, .20, .19, .19, .17, .21, .18
6694	1	1.000	.460	.460	15,360	33,390	26,485	57,580	2.23	27.9	.68×.27=.184	60.0	Fine silky	.18, .20, .22, .23, .27, .62*, .31, .20
6995	2	.987	.440	.434	16,480	37,970	26,630	59,060	1.82	22.8	.72×.27=.194	55.3	....do	.32, .46*, .20, .18, .17, .17, .16, .16
4672	1	1.496	.460	.688	23,940	34,810	40,410	58,740	2.61	32.6	1.05×.27=.283	58.9	....do	.24, .27, .75*, .30, .24. .27, .30, .24
4673	2	1.497	.437	.654	25,780	39,420	39,220	59,970	2.49	31.1	1.12×.27=.302	53.8	....do	.27, .29, .31, .39, .63*, .23, .19, .18

STEEL SPECIMENS FROM CHECK PLATES FOR 7-INCH HOWITZER CARRIAGE.



Lengthwise specimens marked L.
Crosswise specimens marked C.

No. of test.	Mark on specimen.	Dimensions in inches.		Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 10 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.						
		Inch.	*Inch.*	*Sq. inch.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Pr. ct.*	" " *Sq. in.*	*Pr. ct.*		" " " " " " " " " "
5195	. L	.995	.509	.506	19,840	39,210	30,090	59,470	2.41	24.1	.72 × .34 = .245	51.6	Fine silky	.21, .19, .21, .24, .17, .20, .60*, .26, .17, .16
5196	. C	.998	.500	.499	19,260	38,600	29,970	60,060	1.45	14.5	.88 × .39 = .343	31.3	Silky serrated, with streaks of light-colored metal.	.26*, .13, .12, .12, .15, .14, .15, .13, .12, .13
5197	.. L	.998	.475	.474	15,800	33,330	25,490	53,780	2.58	25.8	.66 × .27 = .178	62.4	Fine silky	.22, .20, .17, .31, .66*, .24, .23, .20, .17, .18
5198	.. C.	.996	.487	.485	16,600	34,230	25,519	52,600	1.41	14.1	.87 × .40 = .348	28.2	Silky serrated, with streaks of light-colored metal.	.12, .10, .10, .09, .12, .13, .14, .31*, .16, .14

STEEL CASTINGS REPRESENTING METAL FOR 5-INCH SIEGE CARRIAGE.

No. of test.	Mark on specimen.	Dimensions in inches.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 4 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.
				Total.	Per square inch.	Total.	Per square inch.					
			Sq. in.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Inch.*	*Per ct.*		*Per ct.*	
4370	T_1	.564 diam ...	.25	8,980	35,920	14,400	57,600	.10	2.5	Diam. .55 = .238	4.8	Granular, 60 per cent; dull spongy, 40 per cent.
4371	B_2	....do	.25	9,010	36,040	17,350	69,400	.21	5.3	Diam. .54 = .229	8.4	Granular, blow hole in surface ″.08×″.04, extends ″.9 deep.
4372	C_3	....do	.25	9,020	36,080	18,890	75,560	.26	6.5	Diam. .54 = .229	8.4	Granular, small dull spot at the circumference.
								Elongation in 2 inches.				
4373	S_4	....do	.25	11,480	45,920	22,670	90,680	.24	12.0	Diam. .53 = .221	11.6	Granular, radiating from a dull spot at the circumference.
4374	S_5	....do	.25	9,890	39,560	20,160	80,640	.47	23.5	Diam. .47 = .173	30.8	Silky, 50 per cent of surface interspersed with fine granulation.

TENSILE TESTS OF STEEL PLATE FROM NATIONAL ARMORY.

No. of test.	Mark on specimen.	Dimensions in inches.		Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of 1-inch sections.
		Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.						
		Inches.	*Inch.*	*Sq.inch.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Per ct.*	*" " Sq. in.*	*Per ct.*		*" " " "

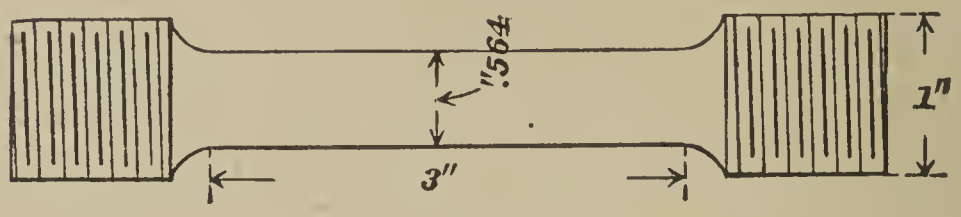
TENSILE TESTS OF STEEL PLATE FROM NATIONAL ARMORY—Continued.

No. of test.	Mark on specimen.	Dimensions in inches.		Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of 1-inch sections.							
		Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.													
		Inches.	*Inch.*	*Sq. inch.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Per ct.*	*" " Sq. in.*	*Per ct.*		*" *	*" *	*" *	*" *	*" *	*" *	*" *	*" *
5252	31	1.503	.200	.301	17,160	57,010	23,620	78,470	1.70	21.3	1.22×.15=.183	39.2	Silky	.17,	.30*,	.42*,	.23,	.19,	.16,	.12,	.11
5253	32	1.502	.193	.290	15,990	55,140	23,360	80,550	1.62	20.3	1.24×.13=.161	44.5	....do	.12,	.17.	.21,	.50*,	.20,	.17,	.13,	.12
5254	33	1.501	.201	.302	18,400	60,930	23,970	79,370	1.87	23.4	1.20×.13=.156	48.3	....do	.13,	.16,	.21,	.54*,	.23,	.22,	.23,	.15
5255	34	1.501	.196	.294	17,100	58,160	23,370	79,490	1.58	19.8	1.23×.12=.148	49.7	....do	.12,	.15,	.15,	.24,	.44*,	.19,	.17,	.12
5256	35	1.499	.201	.301	17,980	59,730	22,210	73,790	1.71	21.4	1.20×.13=.156	48.2	....do	.14,	.18,	.28,	.48*,	.19,	.16,	.16,	.12
5257	36	1.499	.201	.301	18,300	60,800	23,410	77,770	1.47	18.4	1.21×.14=.169	43.9	....do	.17,	.47*,	.18,	.17,	.15,	.13.	.11,	.09
5258	37	1.500	.200	.300	17,830	59,430	24,260	80,870	1.49	18.6	1.22×.12=.146	51.3	....do	.13,	.44*,	.27.	.17,	.14,	.13,	.11,	.10
5259	38	1.500	.198	.297	17,050	57,410	23,420	78,860	1.70	21.3	1.21×.14=.169	43.1	....do	.14,	.23,	.46*,	.20,	.16,	.18,	.16,	.17
5260	39	1,500	.198	.297	18,500	62,290	23,540	79,260	1.76	22.0	1.20×.14=.168	43.4	....do	.16,	.49*,	.21,	.18,	.22,	.21,	.17,	.12
5261	40	1.502	.196	.294	17,380	59,120	23,390	79,560	1.66	20.8	1.21×.13=.157	46.6	....do	.11,	.16,	.17,	.17,	.21,	.49*,	.21,	.14
5262	41	1.502	.199	.299	16,370	54,750	22,510	75,280	1.61	20.1	1.20×.12=.144	51.8	....do	.11,	.15,	.14,	.16,	.16,	.25,	.49*,	.15
5263	42	1.502	.202	.303	17,800	58,750	24,450	80.690	1.37	17.1	1.22×.14=.171	43.6	....do	.17.	.44*,	.17.	.13.	.11,	.11,	.13,	.11
5266	43	1.491	.204	.304	17,690	58,190	23,750	78,125	1.92	24.0	1.19×.13=.155	49.0	....do	.17,	.22,	.51*,	.27,	.22,	.20,	.19,	.14
5267	44	1.493	.198	.296	16,220	54,800	22,810	77,060	1.78	22.3	1.19×.13=.155	47.6	....do	.17,	.21,	.52*,	.25,	.21,	.15,	.15,	.12
5268	45	1.491	.200	.298	15,580	52,280	22,390	75,130	1.98	24.8	1.20×.12=.144	51.7	....do	.17,	.25,	.52*,	.24,	.20,	.22,	.20,	.18
5269	46	1.491	.196	.292	17,720	60,680	22,790	78,050	1.67	20.9	1.22×.11=.134	54.1	....do	.16,	.18,	.16,	.20,	.48*,	.20,	.15,	.14
5270	47	1.492	.199	.297	16,410	55,250	23,020	77,510	1.74	21.8	1.19×.13=.155	47.8	....do	.17,	.41*,	.33,	.21,	.20,	.17,	.13,	.12
5271	48	1.496	.193	.289	17,690	61,210	22,610	78,240	1.62	20.3	1.20×.13=.156	46.0	....do	.13,	.18,	.22,	.52*,	.17,	.16,	.12,	.12
5272	49	1.495	.196	.293	18,140	61,910	23,480	80,140	1.60	20.0	1.22×.13=.159	45.7	....do	.14,	.16,	.48*,	.20,	.18,	.15,	.16,	.13
5273	50	1.492	.203	.303	17,780	58,680	23,670	78,120	1.65	20.6	1.21×.13=.157	48.2	....do	.12,	.17,	.20,	.49*,	.23,	.17,	.14,	.13
5274	51	1.494	.202	.302	16,210	53,680	22,980	76,090	2.01	25.1	1.19×.12=.143	52.6	....do	.18.	.22,	.58*,	.24,	.23,	.21,	.18,	.17
5275	52	1.490	.205	.305	17,400	57,050	24,060	78,860	1.89	23.6	1.20×.14=.168	44.9	....do	.22,	.50*,	.25,	.22,	.19,	.22,	.17,	.12
5276	53	1.496	.195	.292	15,520	53,150	20,790	71,200	1.78	22.3	1.20×.13=.156	46.6	....do	.19.	.49*,	.29,	.18,	.16,	.15,	.15,	.17
5277	54	1.496	.191	.286	16,800	58,740	21,550	75,350	1.74	21.8	1.22×.12=.146	49.0	....do	.18,	.48*,	.24,	.20,	.18,	.16,	.16,	.14
5278	55	1.493	.195	.291	17,570	60,380	22,210	76,320	1.59	19.9	1.26×.14=.176	39.5	....do	.13,	.14,	.17,	.46*,	.22,	.18,	.17,	.12
5279	56	1.492	.200	.298	17,890	60,030	24,510	82,250	1.77	22.1	1.22×.13=.159	46.6	....do	.17,	.18,	.22,	.49*,	.23,	.19,	.16,	.13
5280	57	1.493	.205	.306	17,030	55,650	23,740	77,580	1.69	21.1	1.22×.15=.183	40.2	....do	.21,	.47*,	.22,	.20,	.19,	.15,	.14,	.11
5299	58	1.506	.201	.303	16,420	54,190	22,710	74,950	1.60	20.0	1.21×.14=.169	44.2	....do	.13,	.17,	.18,	.14,	.15,	.19,	.49*,	.15
5300	59	1.506	.197	.297	16,080	54,140	21,980	74,010	1.67	20.9	1.20×.13=.156	47.5	....do	.13,	.15,	.19,	.21,	.48*,	.21,	.16,	.14
5301	60	1.505	.200	.301	16,500	54,820	21,820	72,490	1.67	20.9	1.22×.12=.146	51.5	....do	.13,	.27,	.45*,	.19,	.19,	.17,	.13,	.14
5302	61	1.506	.200	.301	15,400	51,160	23,170	76,980	1.38	17.3	1.23×.15=.185	38.5	....do	.13,	.30*,	.38*,	.16,	.11,	.10,	.10,	.10
5303	62	1.499	.203	.304	16,550	54,440	23,060	75,860	1.80	22.5	1.19×.13=.155	49.0	....do	.17,	.19,	.21,	.24,	.50*,	.21,	.17,	.11
5304	63	1.500	.200	.300	16,520	55,070	21,920	73,100	1.71	21.4	1.19×.14=.167	44.3	....do	.13,	.19,	.49*,	.26,	.20,	.15,	.17,	.12
5305	64	1.493	.195	.291	16,210	55,700	21.710	74,600	1.82	22.8	1.19×.14=.167	42.6	....do	.14,	.19,	.20,	.49*,	.28,	.22,	.18,	.12
5306	65	1.495	.193	.289	18,290	63,290	23,750	82,180	1.68	21.0	1.19×.13=.155	46.4	....do	.12,	.18,	.20,	.49*,	.21,	.18,	.17,	.13
5307	66	1.491	.193	.288	16,600	57,640	23,290	80,870	1.70	21.3	1.19×.14=.167	42.0	....do	.12,	.17,	.21,	.50*,	.22,	.18,	.17,	.13
5308	67	1.492	.200	.298	16,070	53,930	23,030	77,280	1.79	22.4	1.19×.13=.155	48.0	....do	.13,	.17,	.18,	.26,	.49*,	.23,	.20,	.13
5309	68	1.494	.196	.293	15,050	51,370	22,510	76,830	1.81	22.6	1.20×.12=.144	50.9	....do	.17,	.23,	.50*,	.21,	.19,	.18,	.19,	.14

5310	69	1.495	.198	.296	15,710	53,070	22,580	76,280	1.76	22.0	1.20×.12=.144	51.4	....do	.14, .17, .19, .18, .23, .50*, .20, .15
5311	70	1.496	.193	.289	15,800	54,670	21,050	72,840	1.70	21.3	1.18×.13=.153	47.1	....do	.19, .50*, .21, .17, .16, .17, .18, .12
5312	71	1.493	.201	.300	24,000	80,000	39,480	131,600	.67	8.4	1.34×.18=.241	19.7	Granular 50 per cent, silky 50 per cent.	.07, .24*, .09, .07, .04, .07, .04, .05
5313	72	1.493	.191	.285	17,630	61,860	22,270	78,140	1.49	18.6	1.19×.14=.167	41.4	Silky	.18, .48*, .17, .16, .14, .14, .13, .09
5314	73	1.493	.195	.291	17,500	60,140	23,580	81,030	1.59	19.9	1.22×.12=.146	49.8	....do	.13, .20, .48*, .20, .19, .15, .14, .10
5419	74	1.505	.200	.301	17,310	57,510	21,840	72,560	1.68	21.0	1.22×.11=.134	55.5	....do	.10, .12, .15, .17, .23, .52*, .23, .16
5420	75	1.500	.204	.306	17,280	56,370	22,880	74,770	1.74	21.8	1.22×.13=.159	48.0	....do	.16, .18, .17, .20, .48*, .23, .18, .14
5421	76	1.510	.216	.326	20,810	63,830	27,470	84,260	1.42	17.8	1.26×.14=.176	46.0	....do	.14, .20, .42*, .14, .12, .14, .14, .12
5422	77	1.506	.205	.309	18,650	60,360	24,200	78,320	1.61	20.1	1.26×.14=.176	43.0	Silky, fine lamination.	.16, .27, .41*, .20, .16, .16, .13, .12
5423	78	1.501	.198	.297	*22,500	*75,760	33,560	113,000	.96	12.0	1.30×.13=.169	43.1	Silky	.07, .10, .34*, .11, .10, .08, .09, .07
5424	79	1.506	.195	.294	16,220	55,170	21,970	74,730	1.69	21.1	1.20×.13=.156	46.9	....do	.18, .47*, .25, .16, .16, .18, .16, .13
5425	80	1.506	.198	.298	18,040	60,540	24,030	80,640	1.72	21.5	1.23×.12=.148	50.3	....do	.16, .46*, .25, .18, .19, .18, .17, .13
5426	81	1.505	.198	.298	18,210	61,110	23,920	80,270	1.52	19.0	1.22×.13=.159	46.7	....do	.18, .49*, .19, .15, .16, .13, .12, .10
5427	82	1.499	.191	.286	14,920	52,170	20,890	73,040	1.70	21.3	1.19×.14=.167	41.6	Silky, lamellar....	.14, .18, .23, .50*, .21, .16, .15, .13
5428	83	1.503	.195	.293	17,800	60,750	23,770	81,130	1.37	17.1	1.26×.12=.151	48.5	Silky	.17, .45*, .18, .14, .12, .11, .10, .10
5429	84	1.500	.200	.300	15,510	51,700	21,990	73,300	1.97	24.6	1.22×.13=.159	47.0	....do	.14, .23, .50*, .20, .23, .26, .23, .18
5430	85	1.502	.205	.308	17,660	57,340	24,080	78,180	1.78	22.3	1.26×.13=.164	46.8	....do	.18, .44*, .27, .21, .20, .19, .16, .13
5431	86	1.505	.200	.301	17,750	58,970	24,130	80,170	1.47	18.4	1.23×.13=.160	46.8	....do	.20, .46*, .15, .15, .13, .13, .14, .11
5432	87	1.502	.204	.306	18,200	59,480	23,100	75,490	1.54	19.3	1.22×.12=.146	52.3	....do	.17, .50*, .21, .20, .14, .11, .11, .10
5433	88	1.505	.209	.315	19,040	60,440	25,690	81,550	1.64	20.5	1.24×.14=.174	44.8	....do	.17, .30, .43*, .20, .15, .15, .12, .12
5434	89	1.506	.197	.297	17,000	57,230	22,840	76,900	1.80	22.5	1.22×.14=.171	42.4	....do	.17, .33, .40*, .21, .17, .17, .17, .18
5435	90	1.496	.203	.304	16,970	55,820	22,630	74,440	1.76	22.0	1.22×.15=.183	39.8	....do	.17, .45*, .28, .20, .18, .18, .16, .14
5436	91	1.502	.201	.302	16,300	53,970	22,650	75,000	1.67	20.9	1.21×.15=.181	40.1	....do	.18, .52*, .20, .19, .15, .15, .14, .14
5437	92	1.492	.208	.310	15,900	51,290	22,470	72,480	1.69	21.1	1.19×.14=.167	46.1	....do	.21, .50, .20*, .15, .14, .15, .18, .16
5438	93	1.481	.202	.299	16,450	55,020	23,040	77,060	1.71	21.4	1.21×.13=.157	47.5	....do	.20, .50*, .20, .19, .18, .15, .16, .13
5439	94	1.500	.211	.316	17,400	55,060	23,890	75,600	1.76	22.0	1.22×.13=.159	49.7	Silky, slightly lamellar.	.13, .19, .49*, .26, .21, .18, .16, .14
5440	95	1.488	.204	.304	18,150	59,700	21,800	71,710	1.61	20.1	1.20×.14=.168	44.7	Silky	.16, .23, .50*, .21, .17, .12, .12, .10
5441	96	1.494	.200	.299	18,600	62,210	23,610	78,960	1.36	17.0	1.20×.14=.168	43.8	....do	.21, .46*, .16, .14, .10, .11, .09, .09
5442	97	1.493	.203	.303	Indefinite.		40,080	132,280	.74	9.3	1.38×.18=.248	18.1	Silky 20 per cent, granular 80 per cent	.07, .06, .09, .19*, .14, .06, .08, .05
5443	98	1,496	.197	.295	18,950	64,240	23,320	79,050	1.57	19.6	1.21×.14=.169	42.7	Silky	.13, .15, .19, .50*, .19, .15, .13, .13
5444	99	1.492	.212	.316	19,980	63,220	24,940	78,920	1.62	20.3	1.22×.15=.183	42.1	....do	.15, .46*, .24, .17, .18, .19, .12, .11
5445	100	1.485	.199	.296	17,650	59,630	23,690	80,030	1.80	22.5	1.19×.14=.167	43.6	....do	.13, .16, .20, .28, .49*, .22, .18, .14
5446	101	1.497	.200	.299	16,170	54,080	22,120	73,980	1.90	23.8	1.22×.12=.146	51.2	....do	.23, .53*, .21, .20, .23, .20, .17, .13
5447	102	1.497	.191	.286	16,240	56,780	20,870	72,970	1.72	21.5	1.24×.12=.149	47.9	....do	.16, .17, .17, .21, .47*, .22, .18, .14
5448	103	1.492	.197	.294	15,160	51,560	21,520	73,200	1.78	22.3	1.20×.13=.156	46.9	....do	.18, .50*, .20, .16, .22, .21, .16, .15
5449	104	1.507	.192	.289	15,480	53,560	22,190	76,780	1.71	21.4	1.19×.14=.167	42.2	....do	.19, .31, .42*, .19, .18, .16, .14, .12
5450	105	1.495	.202	.302	17,100	56,620	23,490	77,780	1.77	22.1	1.21×.12=.145	52.0	....do	.21, .48*, .17, .15, .16, .20, .22, .18
5451	106	1.500	.206	.309	17,630	57,050	24,200	78,320	1.62	20.3	1.21×.14=.169	45.3	....do	.21, .49*, .18, .15, .15, .15, .16, .13
5452	107	1.489	.195	.290	16,750	57,760	21,010	72,450	1.70	21.3	1.22×.11=.134	53.8	....do	.16, .27, .46*, .22, .20, .15, .13, .11
5453	108	1.490	.197	.294	17,980	61,160	22,920	77,960	1.71	21.4	1.24×.12=.149	49.3	....do	.13, .16, .21, .30, .42, .21, .16, .12

*Approximate.

TENSILE TEST OF SPECIMENS REPRESENTING METAL IN FIXTURES FOR STRAINING 8-INCH TUBE.



No. 4356.

Marks, $\frac{W\ A\ J\ C}{T_1\ M}$
Sectional area, .25 square inch.
Elastic limit, 13,840 pounds=55,360 pounds per square inch.
Tensile strength, 25,270 pounds=101,080 pounds per square inch.
Elongation in 3 inches, ".54=18 per cent.
Elongation of inch sections: ".10, ".33*, ".11.
Diameter at fracture, ".43; area, .145 square inch.
Contraction of area, 41.9 per cent.
Appearance of fracture, silky.

No. 4357.

Marks, $\frac{W\ A\ J\ C}{T_2\ M}$
Sectional area, .25 square inch.
Elastic limit, 13,250 pounds=53,000 pounds per square inch.
Tensile strength, 24,210 pounds=96,840 pounds per square inch.
Elongation in 3 inches, ".38=12.7 per cent.
Elongation of inch sections: ".16*, ".13, ".09.
Diameter at fracture, ".51; area, .204 square inch.
Contraction of area, 18.3 per cent.
Appearance of fracture, granular, radiating from a dull spot at the circumference.

No. 4382.

Marks, $\begin{matrix} W & A & J \\ T & & O \end{matrix}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
3,750	15,000	.000433	.000166	.....	.....	
5,000	20,000	.000600	.000167	0.	.....	
6,250	25,000	.000767	.000167	.....	.....	
7,500	30,000	.000967	.000200	0.	.....	
8,750	35,000	.001100	.000133	.....	.....	
10,000	40,000	.001333	.000233	0.	.....	
10,250	41,000	.001400	.000067	.....	.....	Elastic limit.
10,500	42,000	.006833	.005433	.....	.....	
10,750	43,000	.007067	.000234	.....	.....	
11,000	44,000	.007900	.000833	.....	.....	
11,250	45,000	.008500	.000600	.....	.....	
11,750	47,000	.010233	.001733	.....	.....	
12,000	48,000	.010933	.000700	.....	.....	
12,500	50,000	.012167	.001234	.....	.....	
13,000	52,000	.013900	.001733	.....	.....	
13,500	54,000	.015600	.001700	.....	.....	
14,000	56,000	.017433	.001833	.....	.....	
14,500	58,000	.019167	.001734	.....	.....	
15,000	60,000	.021600	.002433	.....	.....	
16,000	64,000	.0283	.0067	.....	.....	
17,000	68,000	.0333	.0050	.....	.....	
18,000	72,000	.0383	.0050	.....	.....	
19,000	76,000	.0433	.0050	.....	.....	
20,000	80,000	.0567	.0134	.....	.....	
21,000	84,000	.0733	.0166	.....	.....	
22,000	88,000	.1100	.0367	.....	.....	
22,380	89,520	.1567	.0467	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,520
Elastic limit per square inch of original section	do...	41,000
Elongation per inch after rupture	inch..	.1633
Elongation per inch under strain at elastic limit	do...	.001400
Reduction in diameter at point of rupture	do...	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		1″.4 from the neck
Character of broken surface		granular, radiating from a dull spot at the circumference
Elongation of inch sections		″.11, ″.21*, ″.17

No. 4383.

Marks, $\overset{W\ A\ J}{T_2\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
3,750	15,000	.000433	.000133	.....	.....	
5,000	20,000	.000600	.000167	0.	.....	
6,250	25,000	.000767	.000167	.....	.....	
7,500	30,000	.000933	.000166	0.	.....	
8,500	34,000	.001133	.000200	.....	.....	Elastic limit.
8,750	35,000	.001233	.000100	.000167	.000167	
9,000	36,000	.002000	.000767	.....	.....	
9,250	37,000	.003833	.001833	.....	.....	
9,500	38,000	.006267	.002434	.....	.....	
9,750	39,000	.006667	.000400	.....	.....	
10,000	40,000	.007600	.000933	.....	.....	
10,250	41,000	.008067	.000467	.....	.....	
10,500	42,000	.008833	.000766	.....	.....	
10,750	43,000	.009667	.000834	.....	.....	
11,000	44,000	.010667	.001000	.....	.....	
11,250	45,000	.011400	.000733	.....	.....	
11,500	46,000	.012333	.000933	.....	.....	
12,000	48,000	.014000	.001667	.....	.....	
12,500	50,000	.016033	.002033	.....	.....	
13,000	52,000	.017733	.001700	.....	.....	
13,500	54,000	.020033	.002300	.....	.....	
14,000	56,000	.022033	.002000	.....	.....	
14,500	58,000	.024367	.002334	.....	.....	
15,000	60,000	.026700	.002333	.....	.....	
15,500	62,000	.029933	.003233	.....	.....	
16,000	64,000	.032667	.002734	.....	.....	
17,000	68,000	.0400	.007333	.....	.....	
18,000	72,000	.0500	.0100	.....	.....	
19,000	76,000	.0633	.0133	.....	.....	
20,000	80,000	.0833	.0200	.....	.....	
21,000	84,000	.1333	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,000
Elastic limit per square inch of original section	do...	34,000
Elongation per inch after rupture	inch...	.1367
Elongation per inch under strain at elastic limit	do...	.001133
Reduction in diameter at point of rupture	do...	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		″.95 from the neck
Character of broken surface		flaky surface, with patches of granular and silky metal interspersed
Elongation of inch sections		″.13, ″.14, ″.14*

TENSILE TESTS OF STEEL SPECIMENS FROM A ROLLED BAR.

Tested for the purpose of comparing the Bethlehem Iron Company's machine with the testing machine at this arsenal.

Length of stem, 4″ Diameter, 1″.128. Sectional area, 1 square inch.

No. of test.	Marks.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 4 inches.		Diameter at fracture.	Area.	Contraction of area.
		Pounds.	*Pounds.*	*Inch.*	*Per cent.*	*Inch.*	*Sq. inch.*	*Per cent.*
4688...	$CT_4—L_2$	47,560	77,410	.94	23.5	.91	.650	35.0
4689...	$CT_4—L_4$	44,840	77,408	.87	21.8	.91	.650	35.0
4690...	$CT_4—L_6$	44,630	77,335	.89	22.3	.91	.650	35.0
4691...	$CT_4—L_8$	43,970	77,390	.93	23.3	.91	.650	35.0
4692...	$CT_4—L_{10}$	44,910	77,030	.94	23.5	.91	.650	35.0
4693...	$CT_4—L_{12}$	45,370	77,188	.97	24.3	.91	.650	35.0

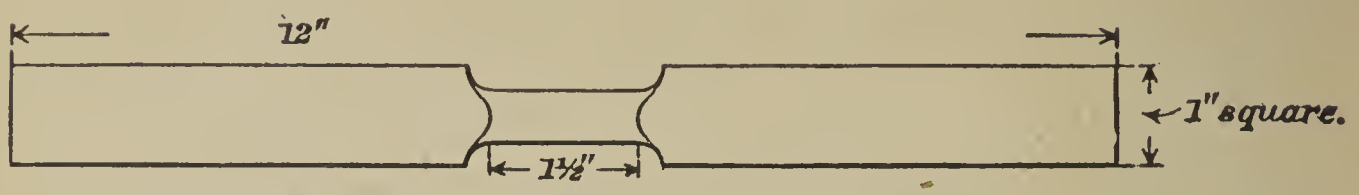
No. of test.	Elongation of inch sections.	Appearance of fracture.	Duration of tests.		
			To elastic limit.	Elastic limit to maximum load.	Maximum load to time of rupture.
	″ ″ ″ ″		′ ″	′ ″	′ ″
4688...	.14, .33*, .32*, .15	Silky.....	2 10	6 30	2 5
4689...	.13 .23, .36*, .15	.....do.....	2 5	8 0	2 0
4690...	.12, .22, .39*, .16	.....do.....	2 35	6 45	2 35
4691...	.14, .25, .39*, .15	.....do.....	1 54	6 10	2 7
4692...	.14, .28, .37*, .15	.....do.....	2 18	6 30	2 20
4693...	.15, .33*, .34, .15	.....do.....	2 10	5 10	2 18

The elastic limits of above specimens were taken from observations at the beam of the weighing scale. It was found that each of the specimens possessed a well-defined yielding point, after which elongation continued for a brief interval under diminished loads. The maximum stress reached before yielding occurred is recorded as the elastic limit. A more critical and probably more exact definition obtained from micrometer observations, would have placed the elastic limits from 100 to 400 pounds lower than here recorded.

Following the example of the Bethlehem tests, no change in the rate of speed was given for a short time preceding the time of maximum load and the time of rupture.

The contraction of area being uniform within measurable limits, it is thought that the interval of time between the maximum load and the time of rupture is an index of the speed of the test at the critical period of maximum load. If such is the case the time of these tests was practically a little longer than the Bethlehem tests, and, from the behavior of the metal, it is thought that an acceleration in the speed of testing at the time of reaching the maximum load would have caused an apparent tensile strength a little higher than here recorded, but not more than 100 to 300 pounds would be expected.

STEEL CASTINGS FORWARDED BY LT. COL. J. P. FARLEY FROM I. G. JOHNSON & CO., SPUYTEN DUYVIL, N. Y.



No. of test.	Mark on specimen.	Diameter.	Sectional area.	Ultimate strength.		Elongation in 1 inch.		Area at fracture.	Contraction of area.	Appearance of fracture.
				Total.	Per square inch.					
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Inch.*	*Per ct.*	" *Sq. in.*	*Per ct.*	
5285	.	.504	.20	19,340	96,700	.04	4.0	Diam. .497=.194	3.0	Fine granular.
5286	..	.510	.204	21,510	105,440	.07	7.0	Diam. .498=.195	4.4	Do.
5287	...	.507	.202	15,320	75,840	.05	5.0	Diam. .495=.192	4.9	Coarse granular.
5288	....	.508	.203	13,070	64,380	.28	28.0	Diam. .436=.149	26.6	Silky serrated.

ENDURANCE OF ROTATING SHAFTS

OF

CAST-IRON, COLD-ROLLED IRON AND STEEL.

669

ENDURANCE OF ROTATING SHAFTS.

No. 30.—*Cast (gun) iron bar No. 4.*

The speed of the previous run of 37,151,900 rotations was 400 per minute.

Diameter ″.995. Speed of rotation, 2,200 per minute.

Length between end bearings, 33″.

Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
15,000	.....	37,151,900	.....	.....	.....	.....	.....	.....	Bar removed from machine and rested 1 year and 9 months. See report 1890 for previous runs. Middle bearing of bar reduced to ″.995 diameter by wear.
	0	37,151,900	*a*	.2015	.1819	.2008	.0189	.0007	After above-mentioned rest.
			b	.2014	.1819	.2008	.0189	.0006	
			c	.2009	.1812	.2002	.0190	.0007	
	4,950	37,156,850	*a*	.2010	.1818	.2008	.0190	.0002	
			b	.2015	.1818	.2008	.0190	.0007	
			c	.2009	.1811	.2002	.0191	.0007	
	10,150	37,167,000	*a*	.2015	.1818	.2008	.0190	.0007	
			b	.2014	.1817	.2007	.0190	.0007	
			c	.2008	.1813	.2002	.0189	.0006	
	20,060	37,187,060	*a*	.2016	.1818	.2008	.0190	.0008	
			b	.2013	.1815	.2007	.0192	.0006	
			c	.2008	.1813	.2002	.0189	.0006	
	89,940	37,277,000	*a*	.2009	.1817	.2008	.0191	.0001	
			b	.2013	.1817	.2008	.0191	.0005	
			c	.2010	.1814	.2002	.0188	.0008	Test discontinued.

No. 112.—*Cold-rolled iron bar.*

Diameter 1″. Speed of rotation, 2,200 per minute.
Length between end bearings, 33″.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
20,000	0	0	*a*	.1997	.1841	.1996	.0155	.0001	
			b	.2003	.1845	.2002	.0157	.0001	
			c	.2009	.1852	.2008	.0156	.0001	
	5,000	5,000	*a*	.1996	.1838	.1996	.0158	0.	
			b	.2002	.1845	.2002	.0157	0.	
			c	.2010	.1852	.2008	.0156	.0002	
	5,000	10,000	*a*	.1998	.1839	.1996	.0157	.0002	
			b	.2003	.1845	.2002	.0157	.0001	
			c	.2010	.1852	.2008	.0156	.0002	
25,000	0	10,000	*a*	.1998	.1799	.1996	.0197	.0002	
			b	.2003	.1807	.2002	.0195	.0001	
			c	.2011	.1812	.2008	.0196	.0003	
	5,000	15,000	*a*	.1996	.1798	.1996	.0198	0.	
			b	.2003	.1806	.2002	.0196	.0001	
			c	.2011	.1813	.2009	.0196	.0002	
	5,000	20,000	*a*	.1997	.1799	.1995	.0196	.0002	
			b	.2003	.1805	.2002	.0197	.0001	
			c	.2010	.1812	.2008	.0196	.0002	
30,000	0	20,000	*a*	.1998	.1761	.1996	.0235	.0002	
			b	.2003	.1767	.2002	.0235	.0001	
			c	.2011	.1774	.2009	.0235	.0002	
	5,000	25,000	*a*	.1998	.1760	.1995	.0235	.0003	
			b	.2003	.1767	.2001	.0234	.0002	
			c	.2011	.1776	.2008	.0232	.0003	
	5,000	30,000	*a*	.1997	.1759	.1995	.0236	.0002	
			b	.2003	.1766	.2002	.0236	.0001	
			c	.2011	.1774	.2008	.0234	.0003	
35,000	0	30,000	*a*	.1998	.1722	.1996	.0274	.0002	
			b	.2003	.1728	.2002	.0274	.0001	
			c	.2011	.1736	.2008	.0272	.0003	
	5,000	35,000	*a*	.1996	.1720	.1996	.0276	0.	
			b	.2004	.1728	.2001	.0273	.0003	
			c	.2011	.1734	.2008	.0274	.0003	
	5,000	40,000	*a*	.1997	.1721	.1994	.0273	.0003	
			b	.2002	.1727	.2001	.0274	.0001	
			c	.2011	.1734	.2008	.0274	.0003	
	10,000	50,000	*a*	.1997	.1720	.1995	.0275	.0002	
			b	.2003	.1728	.2001	.0273	.0002	
			c	.2011	.1735	.2008	.0273	.0003	
40,000		50,000	*a*	.1998	.1683	.1994	.0311	.0004	
			b	.2004	.1687	.2000	.0313	.0004	
			c	.2011	.1695	.2008	.0313	.0003	
	5,000	55,000	*a*	.1995	.1679	.1994	.0315	.0001	
			b	.2003	.1686	.2000	.0314	.0003	
			c	.2012	.1694	.2008	.0314	.0004	
	5,000	60,000	*a*	.1996	.1679	.1994	.0315	.0002	
			b	.2004	.1686	.1999	.0313	.0005	
			c	.2011	.1695	.2007	.0312	.0004	
	10,000	70,000	*a*	.1997	.1677	.1994	.0317	.0003	
			b	.2006	.1686	.1999	.0313	.0007	
			c	.2012	.1694	.2008	.0314	.0004	

No. 112.—*Cold-rolled iron bar*—Continued.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	70,000	*a*	.1999	.1640	.1994	.0354	.0005	
			b	.2005	.1648	.1999	.0351	.0006	
			c	.2012	.1653	.2006	.0353	.0006	
	5,000	75,000	*a*	.2003	.1638	.1993	.0355	.0010	
			b	.2003	.1643	.1997	.0354	.0006	
			c	.2013	.1653	.2005	.0352	.0008	
	5,000	80,000	*a*	.1988	.1631	.1988	.0357	0.	
			b	.2009	.1644	.1997	.0353	.0012	
			c	.2015	.1650	.2004	.0354	.0011	
	10,000	90,000	*a*	.2006	.1635	.1990	.0355	.0016	The temperature of the bar at the close of this run had increased to about 100° F.
			b	.2002	.1640	.1994	.0354	.0008	
			c	.2017	.1648	.2003	.0355	.0014	
	111,000	211,000	.....	.....	.....	.....	.....	.....	Bar ruptured. Temperature about 300° F.

No. 113.—*Cold-rolled iron bar.*

Diameter, 1″; speed of rotation, 2,200 per minute.
Length between end bearings, 33″.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.1996	.1638	.1993	.0355	.0003	
			b	.2004	.1653	.2002	.0349	.0002	
			c	.2001	.1645	.1998	.0353	.0003	
	10,000	10,000	*a*	.1991	.1634	.1989	.0355	.0002	
			b	.2011	.1647	.1999	.0352	.0012	
			c	.2003	.1641	.1996	.0355	.0007	
	10,000	20,000	*a*	.2009	.1639	.1995	.0356	.0014	Temperature of bar increased slightly.
			b	.2006	.1646	.1998	.0352	.0008	
			c	.2007	.1641	.1996	.0355	.0011	
	10,000	30,000	*a*	.1997	.1632	.1991	.0359	.0006	
			b	.2005	.1643	.1996	.0353	.0009	
			c	.2011	.1636	.1995	.0359	.0016	
	10,000	40,000	*a*	.1990	.1630	.1988	.0358	.0002	
			b	.2020	.1643	.1997	.0354	.0023	
			c	.2009	.1636	.1994	.0358	.0015	
	10,000	50,000	*a*	.1995	.1631	.1989	.0358	.0006	
			b	.2022	.1643	.1996	.0353	.0026	
			c	.2007	.1632	.1992	.0360	.0015	
	50,000	100,000	*a*	.1975	.1608	.1975	.0367	0.	Temperature of bar about 180° F.
			b	.2037	.1632	.2006	.0374	.0031	
			c	.2015	.1638	.2004	.0366	.0011	
	7,000	107,000	.....	.....	.....	.....	.....	.....	Bar ruptured. The temperature of the bar increased gradually during each successive run.

No. 114.—*Cold-rolled iron bar.*

Diameter 1″; speed of rotation, 2,200 per minute.
Length between end bearings, 33″.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2014	.1657	.2012	.0355	.0002	
			b	.1987	.1630	.1984	.0354	.0003	
			c	.2007	.1651	.2004	.0353	.0003	
	10,000	10,000	*a*	.2017	.1654	.2010	.0356	.0007	
			b	.1986	.1630	.1982	.0352	.0004	
			c	.2010	.1649	.2002	.0353	.0008	
	10,000	20,000	*a*	.2019	.1653	.2008	.0355	.0011	Temperature of bar increased slightly.
			b	.1998	.1627	.1984	.0357	.0014	
			c	.2011	.1648	.2001	.0353	.0010	
	10,000	30,000	*a*	.2012	.1649	.2006	.0357	.0006	
			b	.2002	.1628	.1984	.0356	.0018	
			c	.2014	.1646	.2001	.0355	.0013	
	10,000	40,000	*a*	.2000	.1642	.2000	.0358	0.	
			b	.1994	.1623	.1980	.0357	.0014	
			c	.2023	.1645	.2001	.0356	.0022	
	10,000	50,000	*a*	.2031	.1651	.2008	.0357	.0023	
			b	.1992	.1626	.1982	.0356	.0010	
			c	.2014	.1643	.2000	.0357	.0014	
	50,000	100,000	*a*	.2025	.1646	.2008	.0362	.0017	Temperature of bar about 150° F.
			b	.2020	.1636	.1995	.0359	.0025	
			c	.2001	.1629	.1987	.0358	.0014	
	24,600	124,600	.....	.....	.....	.....	.....	.....	Bar ruptured. Temperature about 200° F.
									The temperature of the bar increased gradually during each successive run after 10,000 rotations.

No. 115.—*Cold-rolled iron bar.*

Diameter 1″. Speed of rotation, 2,200 per minute.
Length between end bearings, 33″.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.1999	.1572	.1930	.0358	.0069	Bar annealed at red heat.
			b	.2032	.1551	.1905	.0354	.0127	
			c	.2085	.1584	.1938	.0354	.0147	
	10,000	10,000	*a*	.1966	.1609	.1966	.0357	0.	Temperature of bar about 200° F.
			b	.1991	.1628	.1986	.0358	.0005	
			c	.2051	.1683	.2037	.0354	.0014	
	10,000	20,000	*a*	.1980	.1623	.1980	.0357	0.	
			b	.1979	.1618	.1975	.0357	.0004	
			c	.2050	.1672	.2026	.0354	.0024	
	10,000	30,000	.....	.....	.....	.....	.....	.....	Rested 15 hours without load.
	0	30,000	*a*	.1971	.1618	.1970	.0352	.0001	
			b	.2016	.1651	.2006	.0355	.0010	
			c	.2033	.1669	.2024	.0355	.0008	
	10,000	40,000	*a*	.1975	.1618	.1974	.0356	.0001	Temperature of bar about 100° F.
			b	.1990	.1624	.1980	.0356	.0010	
			c	.2046	.1656	.2012	.0356	.0034	
	10,000	50,000	*a*	.1968	.1612	.1968	.0356	0.	Temperature about 125° F.
			b	.2011	.1636	.1993	.0357	.0018	
			c	.2039	.1651	.2012	.0361	.0027	
	36,600	86,600	.....	.....	.....	.....	.....	.....	Bar ruptured. Temperature of bar, 180°.

No. 117.—*Steel bar. Mark* 18.

Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
60,000	0	0	*a*	.1993	.1551	.1987	.0436	.0006	
			b	.1995	.1549	.1989	.0440	.0006	
			c	.1998	.1550	.1991	.0441	.0007	
	10,000	10,000	*a*	.1898	.1393	.1866	.0473	.0032	Temperature of bar increased to about 200° F.
			b	.2256	.1693	.2138	.0445	.0118	
			c	.1918	.1383	.1843	.0460	.0075	
	8,600	18,600	.....	.....	.....	.....	.....	.....	Bar ruptured. Temperature about 200° F.

No. 118.—*Steel bar. Mark* 15.

Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
60,000	0	0	*a*	.1981	.1526	.1978	.0452	.0003	
			b	.1985	.1531	.1983	.0452	.0002	
			c	.1984	.1531	.1981	.0450	.0003	
	10,000	10,000	*a*	.1984	.1497	.1955	.0458	.0029	Temperature about 125° F.
			b	.1980	.1497	.1956	.0459	.0024	
			c	.2012	.1554	.1964	.0410	.0048	
	70,400	80,400	.....	.....	.....	.....	.....	.....	Bar ruptured. Temperature about 125° F.

No. 119.—*Steel bar. Mark 12.*

Diameter 1″; speed of rotation, 400 per minute.
Length between end bearings, 33″.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.1989	.1692	.1988	.0296	.0001	
			b	.1991	.1694	.1990	.0296	.0001	
			c	.1989	.1691	.1988	.0297	.0001	
	10,000	10,000	*a*	.1989	.1691	.1988	.0297	.0001	
			b	.1991	.1694	.1990	.0296	.0001	
			c	.1989	.1692	.1988	.0296	.0001	
	40,000	50,000	*a*	.1988	.1690	.1987	.0297	.0001	
			b	.1992	.1695	.1990	.0295	.0002	
			c	.1989	.1691	.1988	.0297	.0001	
	50,000	100,000	*a*	.1989	.1691	.1989	.0298	0.	
			b	.1991	.1694	.1990	.0296	.0001	
			c	.1990	.1691	.1988	.0297	.0002	
	100,000	200,000	*a*	.1989	.1690	.1988	.0298	.0001	
			b	.1992	.1693	.1991	.0298	.0001	
			c	.1990	.1690	.1988	.0298	.0002	
	100,000	300,000	*a*	.1989	.1691	.1988	.0297	.0001	
			b	.1992	.1694	.1991	.0297	.0001	
			c	.1990	.1690	.1988	.0298	.0002	
	624,750	924,750	*a*	.1989	.1691	.1988	.0297	.0001	
			b	.1992	.1694	.1991	.0297	.0001	
			c	.1990	.1690	.1988	.0298	.0002	
	2,075,250	3,000,000	*a*	.1989	1690	.1989	.0299	0.	
			b	.1994	.1698	.1993	.0295	.0001	
			c	.1990	.1690	.1989	.0299	.0001	
	1,000,000	4,000,000	*a*	.1989	.1689	.1989	.0300	0.	
			b	.1993	.1694	.1992	.0298	.0001	
			c	.1990	.1690	.1989	.0299	.0001	
	1,004,500	5,004,500	*a*	.1988	.1689	.1988	.0299	0.	
			b	.1992	.1692	.1991	.0299	.0001	
			c	.1990	.1690	.1989	.0299	.0001	
	136,500	5,141,000	.....	.....	.....	.....	.....	.....	Bar ruptured.

SUMMARIZED TABULATION.

No. of test.	Material.	Marks.	Speed of rotation per minute.	Maximum fiber stress per square inch.	Number of rotations.		Remarks.
					Successive.	Total.	
				Pounds.			
30	Cast (gun) iron...	4	400	15,000	37,151,900	37,151,900	Removed from machine and rested 1 year and 9 months.
			2,200	15,000	125,100	37,277,000	Test discontinued.
112	Cold-rolled iron...	.....	2,200	20,000	10,000	10,000	
				25,000	10,000	20,000	
				30,000	10,000	30,000	
				35,000	20,000	50,000	
				40,000	20,000	70,000	
				45,000	141,000	211,000	Bar ruptured.
113	....do	.....	2,200	45,000	107,000	107,000	Do.
114	....do	.....	2,200	45,000	124,600	124,600	Do.
115	....do	.....	2,200	45,000	86,600	86,600	Bar ruptured. This bar was annealed at red heat before testing.
117	Steel.....	18	400	60,000	18,600	18,600	Bar ruptured.
118	....do	15	400	60,000	80,400	80,400	Do.
119	....do	12	400	40,000	5,141,000	5,141,000	Do.

TENSION TESTS

OF

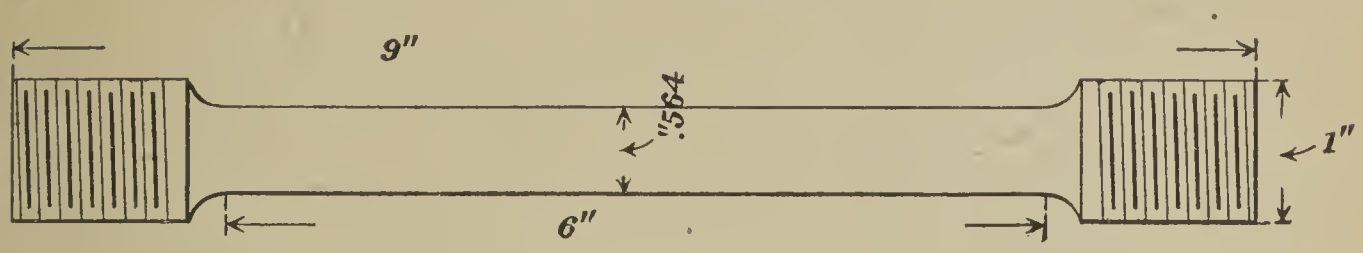
SPECIMENS TAKEN FROM ENDS OF BARS THAT HAD BEEN FRACTURED BY ENDURANCE TESTS OF ROTATING SHAFTS.

Tension tests of samples turned down from ends of endurance bars, after rupture of the latter under repeated stresses.

The specimens were taken from the ends opposite the driving end of the machine.

Marks signify whether steel (S) or iron (I) and the endurance test number.

Form of specimens.



No. 4416.

Marks, S 34.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	----------	
2,500	10,000	.0020	----------	
5,000	20,000	.0038	----------	
7,500	30,000	.0058	0.	
8,750	35,000	.0067	0.	
9,000	36,000	.0069	----------	
9,250	37,000	.0071	----------	
9,500	38,000	.0073	----------	
9,750	39,000	.0076	----------	
10,000	40,000	.0077	0.	
10,250	41,000	.0080	----------	
10,500	42,000	.0082	----------	
10,750	43,000	.0084	----------	
11,000	44,000	.0087	----------	
11,250	45,000	.0089	0.	
11,500	46,000	.0091	----------	
11,750	47,000	.0094	----------	
12,000	48,000	.0096	----------	
12,250	49,000	.0098	----------	
12,500	50,000	.0100	----------	
12,750	51,000	.0101	----------	
13,000	52,000	.0105	----------	Elastic limit.
13,250	53,000	.0119	----------	
11,500	46,000	.0380	----------	
11,750	47,000	.0497	----------	
12,000	48,000	.0650	----------	
12,250	49,000	.1750	----------	
12,500	50,000	.1900	----------	
12,750	51,000	.2000	----------	
13,000	52,000	.2200	----------	
13,500	54,000	.27	----------	
14,000	56,000	.32	----------	
14,500	58,000	.42	----------	
15,000	60,000	.53	----------	
15,500	62,000	.72	----------	
15,740	62,960	1.12	----------	Tensile strength.
10,800	----------	----------	----------	At time of rupture.
0	0	1.60	----------	=26.7 per cent.

Elongation of inch sections: ″.19, ″.59*, ″.24, ″.23, ″.19, ″.16.
Diameter at fracture, ″.33; area, .0855 square inch.
Contraction of area, 65.8 per cent.
Fractured 2″ from the neck.
Appearance, fine silky.

No. 4417.

Marks, S_2–52.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0008	.....	
2,500	10,000	.0018	.....	
5,000	20,000	.0037	.....	
7,500	30,000	.0055	0.	
10,000	40,000	.0077	.....	
11,250	45,000	.0088	.....	Elastic limit.
10,000	40,000	.0368	.....	
10,250	41,000	.0510	.....	
10,500	42,000	.1100	.....	
10,750	43,000	.1550	.....	
11,000	44,000	.1835	.....	
11,250	45,000	.1930	.....	
11,500	46,000	.2120	.....	
12,000	48,000	.27	.....	
12,500	50,000	.29	.....	
13,000	52,000	.36	.....	
13,500	54,000	.41	.....	
14,000	56,000	.50	.....	
14,500	58,000	.60	.....	
15,000	60,000	.79	.....	
15,380	61,520	1.20	.....	Tensile strength.
10,900	.....	.....	.....	At time of rupture.
0	0	1.58	.....	=26.3 per cent.

Elongation of inch sections: ″.18, ″.20, ″.22, ″.24, ″.23, ″.51*.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured ″.50 from the neck. Appearance, fine silky.

No. 4418.

Marks, S_2–53.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0019	.....	
5,000	20,000	.0040	.....	
7,500	30,000	.0061	.....	
10,000	40,000	.0081	0.	
11,250	45,000	.0092	0.	
11,500	46,000	.0094	.....	Elastic limit.
10,250	41,000	.0200	.....	
10,500	42,000	.0500	.....	
10,750	43,000	.0875	.....	
11,000	44,000	.1778	.....	
11,250	45,000	.1830	.....	
11,500	46,000	.1970	.....	
11,750	47,000	.2095	.....	
12,000	48,000	.2350	.....	
12,500	50,000	.28	.....	
13,000	52,000	.34	.....	
13,500	54,000	.39	.....	
14,000	56,000	.47	.....	
14,500	58,000	.59	.....	
15,000	60,000	.78	.....	
15,420	61,680	1.23	.....	Tensile strength.
10,800	.....	.....	.....	At time of rupture.
0	0	1.78	.....	= 29.7 per cent.

Elongation of inch sections: ″.21, ″.56*, ″.36, ″.27, ″.21, ″.17.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured 2″.5 from the neck. Appearance, fine silky.

No. 4419.

Marks, S_3–56.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0008	.....	
2,500	10,000	.0018	.....	
5,000	20,000	.0028	.....	
7,500	30,000	.0058	.....	
10,000	40,000	.0078	.....	
11,250	45,000	.0088	.....	Elastic limit.
10,500	42,000	.0215	.....	
10,750	43,000	.1440	.....	
11,000	44,000	.1675	.....	
11,250	45,000	.1740	.....	
11,500	46,000	.1900	.....	
11,750	47,000	.2045	.....	
12,000	48,000	.2210	.....	
12,500	50,000	.2590	.....	
13,000	52,000	.3065	.....	
14,000	56,000	.41	.....	
14,500	58,000	.51	.....	
15,000	60,000	.61	.....	
15,500	62,000	.80	.....	
15,820	63,280	1.22	.....	Tensile strength.
11,300	.....	.....	.....	At time of fracture.
0	0	1.70	.....	=28.3 per cent.

Elongation of inch sections: ″.20, ″.41*, ″.47*, ″.24, ″.21, ″.17.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured 2″.75 from the neck. Appearance, fine silky.

No. 4420.

Marks, S_3–57.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0008	.....	
2,500	10,000	.0018	.....	
5,000	20,000	.0038	.....	
7,500	30,000	.0058	.....	
10,000	40,000	.0081	.....	
11,250	45,000	.0091	.....	
11,500	46,000	.0092	.....	Elastic limit.
11,750	47,000	.0096	.....	
10,500	42,000	.0155	.....	
10,750	43,000	.0280	.....	
11,000	44,000	.1835	.....	
11,500	46,000	.1880	.....	
12,000	48,000	.2240	.....	
12,500	50,000	.2670	.....	
13,000	52,000	.32	.....	
13,500	54,000	.37	.....	
14,000	56,000	.42	.....	
14,500	58,000	.52	.....	
15,000	60,000	.62	.....	
15,500	62,000	.86	.....	
15,760	63,040	1.24	.....	Tensile strength.
10,900	.....	.....	.....	At time of rupture.
0	0	1.69	.....	=28.2 per cent.

Elongation of inch sections: ″.19, ″.22, ″.27, ″.58*, ″.23, ″.20.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured 2″.9 from the neck. Appearance, fine silky.

No. 4421.

Marks, S_3–58.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0020	.....	
5,000	20,000	.0040	.....	
7,500	30,000	.0061	.....	
10,000	40,000	.0081	0.	
11,250	45,000	.0091	0.	Elastic limit.
11,500	46,000	.0098	.....	
10,500	42,000	.0250	.....	
10,750	43,000	.0435	.....	
11,000	44,000	.1748	.....	
11,250	45,000	.1810	.....	
11,500	46,000	.1920	.....	
11,750	47,000	.2050	.....	
12,000	48,000	.2270	.....	
12,500	50,000	.2690	.....	
13,000	52,000	.3100	.....	
13,500	54,000	.37	.....	
14,000	56,000	.43	.....	
14,500	58,000	.51	.....	
15,000	60,000	.63	.....	
15,500	62,000	.87	.....	
15,750	63,000	1.25	.....	Tensile strength.
11,300	.....	.....	.....	At time of rupture.
0	0	1.71	.....	= 28.5 per cent.

Elongation of inch sections: ″.20, ″.23, ″.54*, ″.32, ″.24, ″.18.

Diameter at fracture, ″.32; area, .0804 square inch.. Contraction of area, 67.8 per cent.

Fractured 3″.75 from the neck. Appearance, fine silky.

No. 4422.

Marks, S_3–15.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0019	.....	
5,000	20,000	.0040	.....	
7,500	30,000	.0061	.....	
10,000	40,000	.0081	.....	
11,250	45,000	.0091	.....	
11,500	46,000	.0092	.....	
11,750	47,000	.0093	.....	Elastic limit.
10,250	41,000	.0200	.....	
10,500	42,000	.0350	.....	
10,750	43,000	.1695	.....	
11,000	44,000	.1730	.....	
11,250	45,000	.1842	.....	
11,500	46,000	.1970	.....	
12,000	48,000	.2260	.....	
12,500	50,000	.2770	.....	
13,000	52,000	.33	.....	
13,500	54,000	.38	.....	
14,000	56,000	.45	.....	
14,500	58,000	.53	.....	
15,000	60,000	.70	.....	
15,500	62,000	.91	.....	
15,820	63,280	1.40	.....	Tensile strength.
11,400	.....	.....	.....	At time of rupture.
0	0	1.78	.....	=29.7 per cent.

Elongation of inch sections: ″.20, ″.25, ″.32, ″.56*, ″.25, ″.20.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured 3″.5 from the neck. Appearance, fine silky.

No. 4430.

Marks, S_4–103.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0008	.....	
2,500	10,000	.0018	.....	
5,000	20,000	.0038	.....	
7,500	30,000	.0057	.....	
10,000	40,000	.0078	.....	
11,250	45,000	.0087	.....	
11,500	46,000	.0089	.....	
11,750	47,000	.0091	.....	Elastic limit.
10,000	40,000	.0168	.....	
10,250	41,000	.0235	.....	
		.1690	.....	
10,500	42,000	.1780	.....	
10,750	43,000	.1832	.....	
11,000	44,000	.1980	.....	
11,250	45,000	.2075	.....	
11,500	46,000	.2290	.....	
11,750	47,000	.2460	.....	
12,000	48,000	.2680	.....	
12,500	50,000	.3200	.....	
13,000	52,000	.39	.....	
13,500	54,000	.46	.....	
14,000	56,000	.56	.....	
14,500	58,000	.68	.....	
15,000	60,000	.96	.....	
15,170	60,680	1.36	.....	Tensile strength.
10,200	.....	.....	.....	At time of rupture.
0	0	1.72	.....	=28.7 per cent.

Elongation of inch sections: ″.19, ″.53*, ″.35, ″.24, ″.21, ″.20.
Diameter at fracture, ″.31; area, .0755 square inch.
Contraction of area, 69.8 per cent.
Fractured 2″.5 from the neck. Appearance, fine silky.

No. 4431.

Marks, S_4–104.
Diameter ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0020	.....	
5,000	20,000	.0041	.....	
7,500	30,000	.0064	.....	
10,000	40,000	.0084	0.	
11,250	45,000	.0092	0.	
11,500	46,000	.0095	.....	
11,750	47,000	.0097	.....	
12,000	48,000	.0100	.....	
12,250	49,000	.0102	.....	Elastic limit.
10,000	40,000	.0205	.....	
10,250	41,000	.0438	.....	
10,500	42,000	.1185	.....	
10,750	43,000	.1862	.....	
11,000	44,000	.1950	.....	
11,500	46,000	.2275	.....	
12,000	48,000	.2575	.....	
12,500	50,000	.3050	.....	
13,000	52,000	.3650	.....	
13,500	54,000	.43	.....	
14,000	56,000	.52	.....	
14,500	58,000	.68	.....	
15,000	60,000	.91	.....	
15,270	61,080	1.30	.....	Tensile strength.
10,200	.....	.....	.....	At time of rupture.
0	0	1.72	.....	= 28.7 per cent.

Elongation of inch sections: ″.19, ″.25, ″.62,* ″.26, ″.22, ″.18.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured 3″.15 from the neck. Appearance, fine silky.

No. 4432.

Marks, S_4,–105.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0007	.....	
2,500	10,000	.0017	.....	
5,000	20,000	.0038	.....	
7,500	30,000	.0059	.....	
10,000	40,000	.0079	0.	
11,250	45,000	.0089	0.	
11,500	46,000	.0091	.....	
11,750	47,000	.0093	.....	Elastic limit.
10,000	40,000	.0171	.....	
10,250	41,000	.0215	.....	
10,500	42,000	.1250	.....	
10,750	43,000	.1870	.....	
11,000	44,000	.1990	.....	
11,500	46,000	.2250	.....	
12,000	48,000	.2570	.....	
12,500	50,000	.3100	.....	
13,000	52,000	.37	.....	
13,500	54,000	.46	.....	
14,000	56,000	.54	.....	
14,500	58,000	.67	.....	
15,000	60,000	.90	.....	
15,240	60,960	1.32	.....	Tensile strength.
10,000	.....	.....	.....	At time of rupture.
0	0	1.83	.....	=30.5 per cent.

Elongation of inch sections: ″.21, ″.28, ″.64*, ″.28, ″.23, ″.19.
Diameter at fracture, ″.31; area, .0755 square inch.
Contraction of area, 69.8 per cent.
Fractured 3″.25 from the neck. Appearance, fine silky.

No. 4433.

Marks, S_4–106.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0020	.....	
5,000	20,000	.0041	.....	
7,500	30,000	.0061	.....	
10,000	40,000	.0082	.0001	
11,250	45,000	.0092	.0001	
11,500	46,000	.0096	.....	
11,750	47,000	.0099	.....	
12,000	48,000	.0101	.....	
12,250	49,000	.0102	.....	Elastic limit.
10,500	42,000	.0198	.....	
10,750	43,000	.0350	.....	
		.1394	.....	
11,000	44,000	.2030	.....	
11,250	45,000	.2105	.....	
11,500	46,000	.2180	.....	
11,750	47,000	.2300	.....	
12,000	48,000	.2550	.....	
12,500	50,000	.3050	.....	
13,000	52,000	.3550	.....	
13,500	54,000	.44	.....	
14,000	56,000	.51	.....	
14,500	58,000	.67	.....	
15,000	60,000	.85	.....	
15,300	61,200	1.31	.....	Tensile strength.
10,400	.....	.....	.....	At time of rupture.
0	0	1.72	.....	=28.7 per cent.

Elongation of inch sections: ″.19, ″.22, ″.40*, ″.46*, ″.25, ″.20.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured at middle of the stem. Appearance, fine silky.

No. 4423.

Marks, S_6–84.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0020	.....	
5,000	20,000	.0048	.....	
7,500	30,000	.0058	.....	
10,000	40,000	.0079	.....	
11,250	45,000	.0090	.....	
11,500	46,000	.0092	.....	
11,750	47,000	.0094	.....	Elastic limit.
10,500	42,000	.0680	.....	
10,750	43,000	.1300	.....	
11,000	44,000	.1980	.....	
11,250	45,000	.2010	.....	
11,500	46,000	.2185	.....	
11,750	47,000	.2350	.....	
12,000	48,000	.2590	.....	
12,500	50,000	.3085	.....	
13,000	52,000	.37	.....	
13,500	54,000	.45	.....	
14,000	56,000	.56	.....	
14,500	58,000	.70	.....	
15,000	60,000	.96	.....	
15,110	60,440	1.27	.....	Tensile strength.
10,500	.....	.....	.....	At time of rupture.
0	0	1.74	.....	=29 per cent.

Elongation of inch sections: ″.19, ″.49*, ″.35, ″.26, ″.25, ″.20.
Diameter at fracture, ″.33; area, .0855 square inch.
Contraction of area, 65.8 per cent.
Fractured 2″.5 from the neck. Appearance, fine silky.

No. 4424.

Marks, S_6–85.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0019	.....	
5,000	20,000	.0039	.....	
7,500	30,000	.0060	.....	
10,000	40,000	.0081	0.	
11,250	45,000	.0091	.....	
11,500	46,000	.0092	.....	
11,750	47,000	.0093	.....	Elastic limit.
10,500	42,000	.0268	.....	
10,750	43,000	.0965	.....	
11,000	44,000	.1960	.....	
11,250	45,000	.2000	0.	
11,500	46,000	.2125	.....	
11,750	47,000	.2230	.....	
12,000	48,000	.2475	.....	
12,500	50,000	.2950	.....	
13,500	54,000	.43	.....	
14,000	56,000	.52	.....	
14,500	58,000	.63	.....	
15,000	60,000	.86	.....	
15,310	61,240	1.33	.....	Tensile strength.
10,400	.....	.....	.....	At time of rupture.
0	0	1.79	.....	= 29.8 per cent.

Elongation of inch sections: ″.19, ″.25, ″.33, ″.59*, ″.24, ″.19.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured 3″.5 from the neck. Appearance, fine silky.

No. 4425.

Marks, S_6–86.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0018	.....	
5,000	20,000	.0038	.....	
7,500	30,000	.0058	.....	
10,000	40,000	.0078	0.	
11,250	45,000	.0088	—.0001	
11,500	46,000	.0090	.....	
11,750	47,000	.0091	.....	
12,000	48,000	.0094	.....	Elastic limit.
10,750	43,000	.0137	.....	
		.0164	.....	
11,000	44,000	.0207	.....	
11,250	45,000	.1350	.....	
11,500	46,000	.2115	.....	
11,750	47,000	.2170	.....	
12,000	48,000	.2290	.....	
12,500	50,000	.2620	.....	
13,000	52,000	.3280	.....	
13,500	54,000	.39	.....	
14,000	56,000	.47	.....	
14,500	58,000	.59	.....	
15,000	60,000	.78	.....	
15,440	61,760	1.20	.....	Tensile strength.
11,100	.....	.....	.....	At time of rupture.
0	0	1.66	.....	= 27.7 per cent.

Elongation of inch sections: ″.18, ″.20, ″.23, ″.57*, ″.27, ″.21.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured 2″.9 from the neck. Appearance, fine silky.

No. 4426.

Marks, S_7–87.
Diameter, ″.564.
Sectional area, ″.25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0006	.....	
2,500	10,000	.0017	.....	
5,000	20,000	.0037	.....	
7,500	30,000	.0057	.....	
10,000	40,000	.0078	0.	
11,250	45,000	.0088	0.	
11,500	46,000	.0089	.....	
11,750	47,000	.0092	.....	
12,000	48,000	.0093	.....	Elastic limit.
10,500	42,000	.0122	.....	
10,750	43,000	.0145	.....	
11,000	44,000	.0200	.....	
11,250	45,000	.1925	.....	
11,500	46,000	.1980	.....	
11,750	47,000	.2080	.....	
12,000	48,000	.2275	.....	
12,250	49,000	.2350	.....	
12,500	50,000	.2550	.....	
13,000	52,000	.3020	.....	
13,500	54,000	.36	.....	
14,000	56,000	.41	.....	
14,500	58,000	.49	.....	
15,000	60,000	.69	.....	
15,500	62,000	.76	.....	
16,000	64,000	1.13	.....	
16,020	64,080	1.26	.....	Tensile strength.
11,400	.....	.....	.....	At time of rupture.
0	0	1.82	.....	=30.3 per cent.

Elongation of inch sections: ″.19, ″.26, ″.35, ″.59, ″.24, ″.19.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured 3″.4 from the neck. Appearance, fine silky.

No. 4427.

Marks, S_7–88.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0020	.....	
5,000	20,000	.0044	.....	
7,500	30,000	.0064	0.	
10,000	40,000	.0082	0.	
11,250	45,000	.0093	0.	
11,500	46,000	.0094	.....	
11,750	47,000	.0096	.....	Elastic limit.
10,500	42,000	.0168	.....	
10,750	43,000	.0235	.....	
11,000	44,000	.1650	.....	
11,250	45,000	.1810	.....	
11,500	46,000	.1905	.....	
11,750	47,000	.2015	.....	
12,000	48,000	.2250	.....	
12,500	50,000	.2510	.....	
13,000	52.000	.2950	.....	
13,500	54,000	.3530	.....	
14,000	56,000	.41	.....	
14,500	58,000	.50	.....	
15,000	60,000	.61	.....	
15,500	62,000	.80	.....	
16,000	64,000	1.14	.....	
16,040	64,160	1.35	.....	Tensile strength.
11,400	.....	.....	.....	At time of rupture.
0	0	1.68	.....	= 28 per cent.

Elongation of inch sections: ″.19, ″.22, ″.31, ″.54*, ″.23, ″.19.
Diameter at fracture, ″.33; area, .0855 square inch.
Contraction of area, 65.8 per cent.
Fractured at middle of stem. Appearance, fine silky.

No. 4428.

Marks, S_7–89.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0019	.....	
5,000	20,000	.0038	.....	
7,500	30,000	.0058	.....	
10,000	40,000	.0079	0.	
11,250	45,000	.0089	0.	
11,500	46,000	.0091	.....	
11,750	47,000	.0093	.....	Elastic limit.
10,750	43,000	.0151	.....	
11,000	44,000	.0197	.....	
		.1400	.....	
11,250	45,000	.1780	.....	
11,500	46,000	.1870	.....	
11,750	47,000	.1950	.....	
12,000	48,000	.2100	.....	
12,500	50,000	.2500	.....	
13,000	52,000	.2950	.....	
13,500	54,000	.3380	.....	
14,500	58,000	.48	.....	
15,000	60,000	.58	.....	
15,500	62,000	.73	.....	
16,000	64,000	1.12	.....	
16,040	64,160	1.28	.....	Tensile strength.
11,800	.....	.....	.....	At time of rupture.
0	0	1.76	.....	=29.3 per cent.

Elongation of inch sections: ″.19, ″.47*, ″.42*, ″.23, ″.23, ″.22.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured 2.″6 from the neck. Appearance, fine silky.

No. 4429.

Marks, S_7–90.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0019	.....	
5,000	20,000	.0040	.....	
7,500	30,000	.0060	.....	
10,000	40,000	.0081	0.	
11,000	44,000	.0089	.....	
10,250	41,000	.0122	.....	
10,500	42,000	.0172	.....	
10,750	43,000	.0430	.....	
11,000	44,000	.1800	.....	Elastic limit.
11,250	45,000	.1920	.....	
11,500	46,000	.2010	.....	
12,000	48,000	.2380	.....	
12,500	50,000	.2680	.....	
13,000	52,000	.32	.....	
13,500	54,000	.37	.....	
14,000	56,000	.42	.....	
14,500	58,000	.50	.....	
15,000	60,000	.60	.....	
15,500	62,000	.80	.....	
15,850	63,400	1.22	.....	Tensile strength.
11,700	.....	.....	.....	At time of rupture.
0	0	1.73	.....	= 28 8 per cent.

Elongation of inch sections: ″.19, ″.23, ″.28, ″.59*, ″.25, ″.19.
Diameter at fracture, ″.32; area, .0804 square inch.
Contraction of area, 67.8 per cent.
Fractured 3″.4 from the neck. Appearance, fine silky.

No. 4434.

Marks, I_2–47.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6.″

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0008	.....	
2,500	10,000	.0017	.....	
5,000	20,000	.0037	.....	
7,500	30,000	.0057	.....	
7,750	31,000	.0059	.....	
8,000	32,000	.0061	.....	Elastic limit.
7,500	30,000	.0192	.....	
7,750	31,000	.0212	.....	
8,000	32,000	.0250	.....	
8,250	33,000	.0360	.....	
8,500	34,000	.0650	.....	
8,750	35,000	.1200	.....	
9,000	36,000	.1600	.....	
9,250	37,000	.1640	.....	
9,500	38,000	.1678	.....	
9,750	39,000	.1765	.....	
10,000	40,000	.1970	.....	
10,250	41,000	.2130	.....	
10,500	42,000	.2360	.....	
10,750	43,000	.2580	.....	
11,000	44,000	.2850	.....	
11,250	45,000	.31	.....	
11,500	46,000	.36	.....	
11,750	47,000	.39	.....	
12,000	48,000	.42	.....	
12,250	49,000	.46	.....	
12,500	50,000	.52	.....	
12,750	51,000	.59	.....	
13,000	52,000	.69	.....	
13,250	53,000	.81	.....	
13,500	54,000	1.07	.....	
13,550	54,200	1.27	.....	Tensile strength.
0	0	1.51	.....	=25.2 per cent.

Elongation of inch sections: ″.18, ″.23, ″.31, ″.37*, ″.22, ″.20.
Diameter at fracture, ″.43; area, .1452 square inch.
Contraction of area, 41.9 per cent.
Fractured 3″.5 from the neck.. Appearance, fibrous, lamellar,

No. 4435.

Marks, I_4–61.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0040	0.	
6,250	25,000	.0051	.....	
7,500	30,000	.0061	0.	
7,750	31,000	.0064	.....	
8,000	32,000	.0067	.....	Elastic limit.
7,500	30,000	.0152	.....	
7,750	31,000	.0198	.....	
8,000	32,000	.1162	.....	
8,250	33,000	.1230	.....	
8,500	34,000	.1390	.....	
9,000	36,000	.1675	.....	
9,500	38,000	.2100	.....	
10,000	40,000	.2560	.....	
10,500	42,000	.3130	.....	
11,000	44,000	.40	.....	
11,500	46,000	.50	.....	
12,000	48,000	.61	.....	
12,500	50,000	.87	.....	
12,810	51,240	1.40	.....	Tensile strength.
11,200	.....	.....	.....	At time of rupture.
0	0	1.70	.....	= 28.3 per cent.

Elongation of inch sections: ″.20, ″.23, ″.33, ″.46*, ″.25, ″.23.
Diameter at fracture, ″.40; area, .1257 square inch.
Contraction of area, 49.7 per cent.
Fractured at middle of stem. Appearance, fibrous.

No. 4436.

Marks, I_4–62.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0040	.....	
6,250	25,000	.0050	.....	
7,500	30,000	.0060	0.	
7,750	31,000	.0062	.....	
8,000	32,000	.0067	.....	Elastic limit.
7,500	30,000	.0129	.....	
7,750	31,000	.0170	.....	
8,000	32,000	.0320	.....	
8,250	33,000	.0640	.....	
8,500	34,000	.1270	.....	
8,750	35,000	.1350	.....	
9,000	36,000	.1470	.....	
9,250	37,000	.1640	.....	
9,500	38,000	.1820	.....	
9,750	39,000	.1975	.....	
10,000	40,000	.2260	.....	
10,250	41,000	.2470	.....	
10,500	42,000	.2790	.....	
10,750	43,000	.3050	.....	
11,000	44,000	.34	.....	
11,250	45,000	.38	.....	
11,500	46,000	.42	.....	
12,000	48,000	.51	.....	
12,500	50,000	.57	.....	
13,000	52,000	1.02	.....	
13,050	52,200	1.29	.....	Tensile strength.
11,500	.....	.....	.....	At time of rupture.
0	0	1.48	.....	=24.7 per cent.

Elongation of inch sections: ″.19, ″.26, ″.46*, ″.22, ″.18, ″.17.
Diameter at fracture, ″.41; area, .132 square inch.
Contraction of area, 47.2 per cent.
Fractured 2″.9 from the neck. Appearance, fibrous. Color varies from dark to light.

No. 4437.

Marks, I_4-63.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0021	.....	
3,750	15,000	.0031	.....	
5,000	20,000	.0041	.....	
6,250	25,000	.0052	.....	
7,500	30,000	.0062	.0001	
7,750	31,000	.0065	.....	
8,000	32,000	.0068	.....	
8,250	33,000	.0070	.....	Elastic limit.
8,500	34,000	.0077	.....	
7,500	30,000	.0122	.....	
7,750	31,000	.0180	.....	
8,000	32,000	.0260	.....	
8,250	33,000	.0450	.....	
8,500	34,000	.0940	.....	
8,750	35,000	.1260	.....	
9,000	36,000	.1370	.....	
9,250	37,000	.1480	.....	
9,500	38,000	.1700	.....	
9,750	39,000	.1820	.....	
10,000	40,000	.2020	.....	
10,250	41,000	.2190	.....	
10,500	42,000	.2470	.....	
10,750	43,000	.2670	.....	
11,000	44,000	.2975	.....	
11,250	45,000	.3230	.....	
11,500	46,000	.36	.....	
11,750	47,000	.40	.....	
12,000	48,000	.45	.....	
12,250	49,000	.49	.....	
12,500	50,000	.57	.....	
12,750	51,000	.62	.....	
13,000	52,000	.72	.....	
13,250	53,000	.87	.....	
13,490	53,960	1.30	.....	Tensile strength.
12,100	.....	.....	.....	At time of rupture.
0	0	1.51	.....	=25.2 per cent.

Elongation of inch sections: ″.17, ″.18, ″.20, ″.22, ″.30, ″.44*.
Diameter at fracture, ″.42; area, .1385 square inch.
Contraction of area, 44.6 per cent.
Fractured 1″.1 from the neck. Appearance, fibrous.

No. 4438.

Marks, I_4–64.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	----------	
2,500	10,000	.0019	----------	
3,750	15,000	.0030	----------	
5,000	20,000	.0040	----------	
6,250	25,000	.0050	----------	
7,500	30,000	.0060	0.	Elastic limit.
7,750	31,000	.0080	----------	
		.0475	----------	
8,000	32,000	.1153	----------	
8,250	33,000	.1217	----------	
8,500	34,000	.1395	----------	
8,750	35,000	.1500	----------	
9,000	36,000	.1647	----------	
9,250	37,000	.1820	----------	
9,500	38,000	.2140	----------	
9,750	39,000	.24	----------	
10,000	40,000	.27	----------	
10,250	41,000	.29	----------	
10,500	42,000	.33	----------	
10,750	43,000	.36	----------	
11,000	44,000	.41	----------	
11,250	45,000	.45	----------	
11,500	46,000	.51	----------	
11,750	47,000	.57	----------	
12,000	48,000	.65	----------	
12,250	49,000	.75	----------	
12,500	50,000	.95	----------	
12,650	50,600	1.28	----------	Tensile strength.
11,150	----------	----------	----------	At time of rupture.
0	0	1.56	----------	= 26 per cent.

Elongation of inch sections: ″.21, ″.20, ″.20, ″.44*, ″.31, ″.20.
Diameter at fracture, ″.42; area, .1385 square inch.
Contraction of area, 44.6 per cent.
Fractured 2″.7 from the neck. Appearance, fibrous.

No. 4439.

Marks, I_5–69.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0019	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0041	.....	
6,250	25,000	.0052	.0001	
7,500	30,000	.0064	.0001	
7,750	31,000	.0066	.....	
8,000	32,000	.0069	.....	
8,250	33,000	.0071	.....	
8,500	34,000	.0072	.....	
8,750	35,000	.0075	.....	Elastic limit.
9,000	36,000	.0175	.....	
8,000	32,000	.0263	.....	
8,250	33,000	.0297	.....	
8,500	34,000	.0350	.....	
		.0490	.....	
8,750	35,000	.0555	.....	
9,000	36,000	.0785	.....	
		.1480	.....	
9,250	37,000	.1520	.....	
9,500	38,000	.1572	.....	
9,750	39,000	.1695	.....	
10,000	40,000	.1830	.....	
10,250	41,000	.1975	.....	
10,500	42,000	.2200	.....	
10,750	43,000	.23	.....	
11,000	44,000	.27	.....	
11,250	45,000	.29	.....	
11,500	46,000	.31	.....	
11,750	47,000	.34	.....	
12,000	48,000	.39	.....	
12,250	49,000	.42	.....	
12,500	50,000	.48	.....	
12,750	51,000	.52	.....	
13,000	52,000	.60	.....	
13,250	53,000	.72	.....	
13,500	54,000	.88	.....	
13,640	54,560	1.12	.....	Tensile strength.
12,450	.....	.....	.....	At time of rupture.
0	0	1.41	.....	= 23.5 per cent.

Elongation of inch sections: ″.27, ″.39*, ″.21, ″.18, ″.18, ″.18.
Diameter at fracture, ″.45; area, .1590 square inch.
Contraction of area, 36.4 per cent.
Fractured 1″.5 from the neck. Appearance, fibrous, lamellar.

No. 4441.

Marks, I_6–93.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0041	.....	
6,250	25,000	.0051	.....	
7,500	30,000	.0062	.....	
7,750	31,000	.0064	.....	
8,000	32,000	.0066	.....	
8,250	33,000	.0069	.....	
8,500	34,000	.0071	.....	
8,750	35,000	.0075	.....	Elastic limit.
7,250	29,000	.0330	.....	
7,500	30,000	.0405	.....	
7,750	31,000	.0510	.....	
8,000	32,000	.0820	.....	
8,250	33,000	.1610	.....	
8,500	34,000	.2050	.....	
8,750	35,000	.2190	.....	
9,000	36,000	.2480	.....	
9,250	37,000	.2675	.....	
9,500	38,000	.3140	.....	
9,750	39,000	.35	.....	
10,000	40,000	.40	.....	
10,250	41,000	.43	.....	
10,500	42,000	.49	.....	
10,750	43,000	.57	.....	
11,000	44,000	.67	.....	
11,250	45,000	.75	.....	
11,500	46,000	.94	.....	
11,750	47,000	1.24	.....	Tensile strength.
0	0	1.62	.....	=27 per cent.

Elongation of inch sections: ″.43*, ″.26, ″.26, ″.25, ″.23, ″.19.
Diameter at fracture, ″.41; area, .132 square inch.
Contraction of area, 47.2 per cent.
Fractured 1″.10 from the neck. Appearance, fibrous.

No. 4442.

Marks, I_6 94.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0040	.....	
6,250	25,000	.0051	0.	
7,500	30,000	.0061	0.	
7,750	31,000	.0063	.....	
8,000	32,000	.0066	.....	
8,250	33,000	.0068	.....	
8,500	34,000	.0070	.....	
8,750	35,000	.0072	0.	Elastic limit.
8,000	32,000	.0235	.....	
8,250	33,000	.1260	.....	
8,500	34,000	.2080	.....	
8,750	35,000	.2140	.....	
9,000	36,000	.2370	.....	
9,250	37,000	.2575	.....	
9,500	38,000	.2940	.....	
9,750	39,000	.3210	.....	
10,000	40,000	.38	.....	
10,250	41,000	.40	.....	
10,500	42,000	.47	.....	
10,750	43,000	.52	.....	
11,000	44,000	.61	.....	
11,250	45,000	.69	.....	
11,500	46,000	.84	.....	
11,750	47,000	1.10	.....	
11,760	47,040	1.42	.....	Tensile strength.
0	0	1.68	.....	= 28 per cent.

Elongation of inch sections: ″.27, ″.47*, ″.25, ″.25, ″.22, ″.22.
Diameter at fracture, ″.40; area, .1257 square inch.
Contraction of area, 49.7 per cent.
Fractured 1″.6 from the neck. Appearance, fibrous.

No. 4443.

Marks, I_6–90.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

[Second specimen from this shaft.]

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0040	.....	
6,250	25,000	.0050	.....	
7,500	30,000	.0060	0.	
7,750	31,000	.0062	.....	
8,000	32,000	.0066	.....	
8,250	33,000	.0068	.....	
8,500	34,000	.0070	.....	Elastic limit.
8,750	35,000	.0090	.....	
7,250	29,000	.0145	.....	
7,500	30,000	.0198	.....	
7,750	31,000	.0318	.....	
8,000	32,000	.1085	.....	
8,250	33,000	.1600	.....	
8,500	34,000	.2040	.....	
8,750	35,000	.2150	.....	
9,000	36,000	.2460	.....	
9,250	37,000	.2690	.....	
9,500	38,000	.3050	.....	
9,750	39,000	.34	.....	
10,000	40,000	.39	.....	
10,250	41,000	.43	.....	
10,500	42,000	.49	.....	
10,750	43,000	.56	.....	
11,000	44,000	.67	.....	
11,250	45,000	.77	.....	
11,500	46,000	1.00	.....	
11,610	46,440	1.27	.....	Tensile strength.
10,300	.....	.....	.....	
0	0	1.48	.....	=24.7 per cent.

Elongation of inch sections: ″.21, ″.25, ″.43*, ″.20, ″.20, ″.19.
Diameter at fracture, ″.42; area, .1385 square inch.
Contraction of area, 44.6 per cent.
Fractured 3″ from the neck. Appearance, fibrous.

No. 4444.

Marks, I_6–95.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0031	.....	
5,000	20,000	.0041	.....	
6,250	25,000	.0052	.....	
7,500	30,000	.0063	0.	
7,750	31,000	.0066	.....	
8,000	32,000	.0068	.....	
8,250	33,000	.0071	.....	
8,500	34,000	.0072	.....	
8,750	35,000	.0073	0.	Elastic limit.
9,000	36,000	.0100	.....	
7,250	29,000	.0148	.....	
7,500	30,000	.0212	.....	
7,750	31,000	.0298	.....	
8,000	32,000	.0550	.....	
8,250	33,000	.1220	.....	
8,500	34,000	.2005	.....	
8,750	35,000	.2100	.....	
9,000	36,000	.2370	.....	
9,250	37,000	.2570	.....	
9,500	38,000	.2940	.....	
9,750	39,000	.3200	.....	
10,000	40,000	.39	.....	
10,250	41,000	.41	.....	
10,500	42,000	.49	.....	
10,750	43,000	.53	.....	
11,000	44,000	.63	.....	
11,250	45,000	.71	.....	
11,500	46,000	.92	.....	
11,710	46,840	1.40	.....	Tensile strength.
10,100	.....	.....	.....	At time of rupture.
0	0	1.64	.....	= 27.3 per cent.

Elongation of inch sections: ″.19, ″.30, ″.48*, ″.25, ″.23, ″.19.
Diameter at fracture, ″.40; area, .1257 square inch.
Contraction of area, 49.7 per cent.
Fractured 2″.75 from the neck. Appearance, fibrous.

No. 4440.

Marks, I_7–92.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0040	.....	
6,250	25,000	.0050	.....	
7,500	30,000	.0060	.....	
7,750	31,000	.0062	.....	
8,000	32,000	.0065	.....	
8,250	33,000	.0068	.....	
8,500	34,000	.0071	.....	Elastic limit.
7,500	30,000	.0110	.....	
		.0142	.....	
7,750	31,000	.0219	.....	
8,000	32,000	.0880	.....	
8,250	33,000	.1275	.....	
8,500	34,000	.1790	.....	
8,750	35,000	.1985	.....	
9,000	36,000	.2250	.....	
9,250	37,000	.2390	.....	
9,500	38,000	.2840	.....	
9,750	39,000	.3070	.....	
10,000	40,000	.37	.....	
10,250	41,000	.40	.....	
10,500	42,000	.46	.....	
10,750	43,000	.49	.....	
11,000	44,000	.59	.....	
11,250	45,000	.67	.....	
11,500	46,000	.79	.....	
11,750	47,000	1.00	.....	
11,890	47,560	.....	.....	Tensile strength.
0	0	1.68	.....	= 28 per cent.

Elongation of inch sections: ″.23, ″.27, ″.47*, ″.26, ″.25, ″.20.
Diameter at fracture, ″.42; area, .1385 square inch.
Contraction of area, 44.6 per cent.
Fractured 3″.1 from the neck. Appearance, fibrous.

No. 4448.

Marks, I_8–100.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0019	.....	
3,750	15,000	.0029	.....	
5,000	20,000	.0040	.....	
6,250	25,000	.0051	.....	
7,500	30,000	.0062	0.	
7,750	31,000	.0063	.....	
8,000	32,000	.0066	.....	
8,250	33,000	.0068	.....	
8,500	34,000	.0070	.....	
8,750	35,000	.0071	0.	Elastic limit.
9,000	36,000	.0077	.....	
7,750	31,000	.0090	.....	
		.0101	.....	
8,000	32,000	.0140	.....	
8,250	33,000	.0360	.....	
8,500	34,000	.0770	.....	
		.1817	.....	
8,750	35,000	.1860	.....	
9,000	36,000	.1975	.....	
9,250	37,000	.2140	.....	
9,500	38,000	.2375	.....	
9,750	39,000	.2600	.....	
10,000	40,000	.3000	.....	
10,250	41,000	.3240	.....	
10,500	42,000	.38	.....	
10,750	43,000	.40	.....	
11,000	44,000	.47	.....	
11,250	45,000	.52	.....	
11,500	46,000	.60	.....	
11,750	47,000	.68	.....	
12,000	48,000	.81	.....	
12,250	49,000	1.00	.....	
12,340	49,360	1.34	....	Tensile strength.
10,300	.....	.....	.....	At time of rupture.
0	0	1.72	.....	= 28.7 per cent.

Elongation of inch sections: ″.33, ″.49*, ″.26, ″.33, ″.22, ″.19.
Diameter at fracture, ″.38; area, .1134 square inch.
Contraction of area, 54.6 per cent.
Fractured 1″.7 from the neck. Appearance, fibrous.

No. 4449.

Marks, I_8–101.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0019	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0041	.....	
6,250	25,000	.0052	.....	
7,500	30,000	.0063	.0001	
7,750	31,000	.0066	.....	
8,000	32,000	.0068	.....	
8,250	33,000	.0070	.....	
8,500	34,000	.0072	.....	
8,750	35,000	.0075	.0001	
9,000	36,000	.0078	.....	Elastic limit.
7,750	31,000	.0153	.....	
8,000	32,000	.0238	.....	
8,250	33,000	.0350	.....	
8,500	34,000	.1105	.....	
8,750	35,000	.1860	.....	
9,000	36,000	.1940	.....	
9,250	37,000	.2020	.....	
9,500	38,000	.2270	.....	
9,750	39,000	.2430	.....	
10,000	40,000	.2740	.....	
10,250	41,000	.3040	.....	
10,500	42,000	.36	.....	
10,750	43,000	.39	.....	
11,000	44,000	.43	.....	
11,250	45,000	.48	.....	
11,500	46,000	.55	.....	
11,750	47,000	.61	.....	
12,000	48,000	.69	.....	
12,250	49,000	.85	.....	
12,500	50,000	1.22	.....	Tensile strength.
0	0	1.72	.....	=28.7 per cent.

Elongation of inch sections: ″.19, ″.22, ″.25, ″.27, ″.52*, ″.27.
Diameter at fracture, ″.39; area, .1194 square inch.
Contraction of area, 52.2 per cent.
Fractured 1″.6 from the neck. Appearance, fibrous.

No. 4450.

Marks, I_8–102.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0040	.....	
6,250	25,000	.0051	.....	
7,500	30,000	.0062	0.	
7,750	31,000	.0064	.....	
8,000	32,000	.0066	.....	
8,250	33,000	.0068	.....	
8,500	34,000	.0071	.....	
8,750	35,000	.0072	.....	Elastic limit.
7,500	30,000	.0270	.....	
7,750	31,000	.0292	.....	
8,000	32,000	.0330	.....	
8,250	33,000	.0390	.....	
8,500	34,000	.0500	.....	
8,750	35,000	.1675	.....	
9,000	36,000	.1840	.....	
9,250	37,000	.1971	.....	
9,500	38,000	.2200	.....	
9,750	39,000	.2365	.....	
10,000	40,000	.2640	.....	
10,250	41,000	.2860	.....	
10,500	42,000	.33	.....	
10,750	43,000	.37	.....	
11,000	44,000	.40	.....	
11,250	45,000	.44	.....	
11,500	46,000	.49	.....	
11,750	47,000	.60	.....	
12,000	48,000	.68	.....	
12,250	49,000	.78	.....	
12,500	50,000	.97	.....	
12,630	50,520	1.36	.....	Tensile strength.
0	0	1.88	.....	=31.3 per cent.

Elongation of inch sections: ″.23, ″.30, ″.55, ″.30, ″.27, ″.23.
Diameter at fracture, ″.40; area, .1257 square inch.
Contraction of area, 49.7 per cent.
Fractured 3″ from the neck. Appearance, fibrous.

No. 4451.

Marks, I_8–108.
Diameter, ″.564. Sectional area, .25 square inch. Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0040	.....	
6.250	25,000	.0050	.....	
7,500	30,000	.0060	0.	
7,750	31,000	.0061	.....	
8,000	32,000	.0063	.....	
8,250	33,000	.0067	.....	
8,500	34,000	.0069	.....	
8,750	35,000	.0071	0.	
9,000	36,000	.0074	.....	Elastic limit. Load fell.
		.0110	.....	
		.0122	.....	After 1 minute.
		.0146	.....	After 2 minutes.
		.0156	.....	After 3 minutes.
		.0167	.....	After 4 minutes.
		.0173	.....	After 5 minutes.
		.0182	.....	After 6 minutes.
		.0190	.....	After 7 minutes.
		.0199	.....	After 8 minutes.
		.0205	.....	After 9 minutes.
		.0216	.....	After 10 minutes.
		.0228	.....	After 11 minutes.
		.0248	.....	After 12 minutes.
		.0267	.....	After 13 minutes.
		.0288	.....	After 14 minutes.
		.0312	.....	After 15 minutes.
		.0335	.....	After 16 minutes.
		.0360	.....	After 17 minutes.
		.0393	.....	After 18 minutes.
		.0430	.....	After 19 minutes.
		.0455	.....	After 20 minutes.
		.0482	.....	After 21 minutes.
		.0502	.....	After 22 minutes.
		.0530	.....	After 23 minutes.
		.0557	.....	After 24 minutes.
		.0578	.....	After 25 minutes.
		.0608	.....	After 26 minutes.
		.0633	.....	After 27 minutes.
		.0675	.....	After 28 minutes.
		.0708	.....	After 29 minutes.
		.0740	.....	After 30 minutes.
7,500	30,000	.0772	.....	After 31 minutes.
		.0803	.....	After 32 minutes.
		.0837	.....	After 33 minutes.
		.0871	.....	After 34 minutes.
		.0901	.....	After 35 minutes.
		.0928	.....	After 36 minutes.
		.0947	.....	After 37 minutes.
		.0962	.....	After 38 minutes.
		.0977	.....	After 39 minutes.
		.0990	.....	After 40 minutes.
		.1002	.....	After 41 minutes.
		.1018	.....	After 42 minutes.
		.1035	.....	After 43 minutes.
		.1053	.....	After 44 minutes.
		.1065	.....	After 45 minutes.
		.1075	.....	After 46 minutes.
		.1085	.....	After 47 minutes.
		.1090	.....	After 48 minutes.
		.1092	.....	After 49 minutes.
		.1098	.....	After 50 minutes.
		.1100	.....	After 51 minutes.
		.1101	.....	After 52 minutes.
		.1101	.....	After 53 minutes.
		.1105	.....	After 54 minutes.
		.1105	.....	After 55 minutes.
		.1107	.....	After 56 minutes.
		.1107	.....	After 57 minutes.
		.1107	.....	After 58 minutes.
		.1108	.....	After 59 minutes.
		.1108	.....	After 60 minutes.
		.1111	.....	After 80 minutes.
		.1111	.....	After 85 minutes.

No. 4451—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,750	31,000	.1113	.....	
8,000	32,000	.1137	.....	
8,250	33,000	.1290	.....	
8,500	34,000	.1520	.....	
8,750	35,000	.1660	.....	
9,000	36,000	.1845	.....	
9,250	37,000	.2045	.....	
9,500	38,000	.2250	.....	
9,750	39,000	.2465	.....	
10,000	40,000	.2820	.....	
10,250	41,000	.3140	.....	
10,500	42,000	.37	.....	
10,750	43,000	.40	.....	
11,000	44,000	.45	.....	
11,250	45,000	.49	.....	
11,500	46,000	.57	.....	
11,750	47,000	.63	.....	
12,000	48,000	.78	.....	
12,250	49,000	.93	.....	
12,420	49,680	1.35	.....	Tensile strength.
10,800	.....	.....	.....	At time of rupture.
0	0	1.63	.....	=27.2 per cent.

Elongation of inch sections: ″.19, ″.23, ″.47*, ″.30, ″.23, ″.21.
Diameter at fracture, ″.41; area, .1320 square inch.
Contraction of area, 47.2 per cent.
Fractured at middle of the stem. Appearance, fibrous, lamellar.

No. 4452.

Marks, I_8–109.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0021	.....	
3,750	15,000	.0032	.....	
5,000	20,000	.0044	.....	
6,250	25,000	.0054	.....	
7,500	30,000	.0065	.0001	
7,750	31,000	.0067	.....	
8,000	32,000	.0070	.....	
8,250	33,000	.0072	.....	
8,500	34.000	.0075	.....	
8,750	35,000	.0077	.....	Elastic limit. After sustaining load 15 minutes rapid stretching began.
7,000	28,000	.0124	.....	
7,250	29,000	.0129	.....	
7,500	30,000	.0136	.....	
7,750	31,000	.0150	.....	
8,000	32,000	.0175	.....	
8,250	33,000	.0240	.....	
8,500	34,000	.0312	.....	
8,750	35,000	.0590	.....	
9,000	36,000	.2107	.....	
9,250	37,000	.2240	.....	
9,500	38,000	.2380	.....	
9,750	39,000	.2575	.....	
10,000	40,000	.2850	.....	
10,250	41,000	.3125	.....	
10,500	42,000	.36	.....	
10,750	43,000	.39	.....	
11,000	44,000	.44	.....	
11,250	45,000	.50	.....	
11,500	46,000	.58	.....	
11,750	47,000	.65	.....	
12,000	47,000	.77	.....	
12,250	49,000	.91	.....	
12,420	49,680	1.30	.....	Tensile strength.
0	0	1.77	.....	= 29.5 per cent.

Elongation of inch sections: ″.21, ″.25, ″.27, ″.56*, ″.27, ″.21.
Diameter at fracture, ″.40; area, .1257 square inch.
Contraction of area, 49.7 per cent.
Fractured 3″.25 from the neck. Appearance, fibrous.

No. 4445.

Marks, I_9–96.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0040	.....	
6,250	25,000	.0051	.....	
7,500	30,000	.0061	0.	
7,750	31,000	.0062	.....	Elastic limit.
8,000	32,000	.0070	.....	
7,250	29,000	.0303	.....	
7,500	30,000	.0480	.....	
7,750	31,000	.0558	.....	
8,000	32,000	.0658	.....	
8,250	33,000	.1910	.....	
8,500	34,000	.2190	.....	
8,750	35,000	.2335	.....	
9,000	36,000	.2610	.....	
9,250	37,000	.2820	.....	
9,500	38,000	.3250	.....	
9,750	39,000	.37	.....	
10,000	40,000	.42	.....	
10,250	41,000	.48	.....	
10,500	42,000	.56	.....	
10,750	43,000	.61	.....	
11,000	44,000	.75	.....	
11,250	45,000	.90	.....	
11,420	45,680	1.38	.....	Tensile strength.
0	0	1.65	.....	=27.5 per cent.

Elongation of inch sections: ″.21, ″.28, ″.28, ″.43*, ″.25, ″.20.
Diameter at fracture, ″.42; area, .1385 square inch.
Contraction of area, 44.6 per cent.
Fractured 2″.75 from the neck.
Appearance, fibrous, lamellar. Opened cracks along surface of stem on one side of the specimen.

No. 4446.

Marks, I_9–97.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0041	.....	
6,250	25,000	.0051	.....	
7,500	30,000	.0062	0.	
7,750	31,000	.0065	.....	
8,000	32,000	.0068	.....	
8,250	33,000	.0070	.....	
8,500	34,000	.0071	.....	
8,750	35,000	.0072	0.	Elastic limit.
9,000	36,000	.0078	.....	
7,250	29,000	.0111	.....	
7,500	30,000	.0148	.....	
7,750	31,000	.0205	.....	
8,000	32,000	.0258	.....	
8,250	33,000	.0410	.....	
8,500	34,000	.1740	.....	
8,750	35,000	.2445	.....	
9,000	36,000	.2650	.....	
9,250	37,000	.2805	.....	
9,500	38,000	.3210	.....	
9,750	39,000	.36	.....	
10,000	40,000	.40	.....	
10,250	41,000	.44	.....	
10,500	42,000	.52	.....	
10,750	43,000	.59	.....	
11,000	44,000	.69	.....	
11,250	45,000	.81	.....	
11,500	46,000	1.15	.....	
11,520	46,080	1.39	.....	Tensile strength.
10,050	.....	.....	.....	At time of rupture.
0	0	1.77	.....	= 29.5 per cent.

Elongation of inch sections: ″.23, ″.27, ″.52*, ″.29, ″.25, ″.21.
Diameter at fracture, ″.42; area, .1385 square inch.
Contraction of area, 44.6 per cent.
Fractured 3″ from the neck. Appearance, fibrous.

No. 4447.

Marks, I_9–98.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0010	.....	
2,500	10,000	.0020	.....	
3,750	15,000	.0030	.....	
5,000	20,000	.0041	.....	
6,250	25,000	.0051	.....	
7,500	30,000	.0062	0.	
7,750	31,000	.0063	.....	
8,000	32,000	.0066	.....	
8,250	33,000	.0069	.....	
8,500	34,000	.0071	.....	
8,750	35,000	.0073	.....	Elastic limit.
9,000	36,000	.0100	.....	
6.750	27,000	.0148	.....	
7,000	28,000	.0165	.....	
7,250	29,000	.0201	.....	
7,500	30,000	.0278	.....	
7,750	31,000	.0426	.....	
8,000	32,000	.0720	.....	
8,250	33,000	.1650	.....	
8,500	34,000	.2270	.....	
8,750	35,000	.2420	.....	
9,000	36,000	.2690	.....	
9,250	37,000	.2975	.....	
9,500	38,000	.3440	.....	
9,750	39,000	.38	.....	
10,000	40,000	.43	.....	
10,250	41,000	.49	.....	
10,500	42,000	.56	.....	
10,750	43,000	.62	.....	
11,000	44,000	.80	.....	
11,250	45,000	.92	.....	
11,360	45,440	1.29	.....	Tensile strength.
0	0	1.41	.....	=23.5 per cent.

Elongation of inch sections: ″.47*, ″.21, ″.21, ″.19, ″.17, ″.16.
Diameter at fracture, ″.41; area, .1320 square inch.
Contraction of area, 47.2 per cent.
Fractured ″.70 from the neck. Appearance, fibrous, seamy.

TABULATION OF TENSION SPECIMENS TAKEN FROM ENDS OF BARS THAT HAD BEEN FRACTURED BY ENDURANCE TESTS OF ROTATING SHAFTS.

No. of tension test.	No. of endurance test.	Material.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 6 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
			Inch.	*Sq. in.*	*Pounds*	*Pounds.*	*Per cent.*	*Per cent.*		" " " " " "
4416	34	O. H. steel No. 1	.564	.25	52,000	62,960	26.7	65.8	Fine silky	.19, .59*, .24, .23, .19, .16
4417	52	O. H. steel No. 2	.564	.25	45,000	61,520	26.3	67.8	do	.18, .20, .22, .24, .23, .51*
4418	53	O. H. steel No. 2	.564	.25	46,000	61,680	29.7	67.8	do	.21, .56, .36*, .27, .21, .17
4419	56	O. H. steel No. 3	.564	.25	45,000	63,280	28.3	67.8	do	.20, .41, .47*, .24, .21, .17
4420	57	O. H. steel No. 3	.564	.25	46,000	63,040	28.2	67.8	do	.19, .22, .27, .58*, .23, .20
4421	58	O. H. steel No. 3	.564	.25	45,000	63,000	28.5	67.8	do	.20, .23, .54*, .32, .24, .18
4422	59	O. H. steel No. 3	.564	.25	47,000	63,280	29.7	67.8	do	.20, .25, .32, .56*, .25, .20
4430	103	O. H. steel No. 4	.564	.25	47,000	60,680	28.7	69.8	do	.19, .53*, .35, .24, .21, .20
4431	104	O. H. steel No. 4	.564	.25	49,000	61,080	28.7	67.8	do	.19, .25, .62*, .26, .22, .18
4432	105	O. H. steel No. 4	.564	.25	47,000	60,960	30.5	69.8	do	.21. .28, .64, .28, .23, .19
4433	106	O. H. steel No. 4	.564	.25	49,000	61,200	28.7	67.8	do	.19, .22, .40*, .46*, .25, .20
4423	84	O. H. steel No. 6	.564	.25	47,000	60,440	29.0	65.8	do	.19, .49*, .35, .26, .25, .20
4424	85	O. H. steel No. 6	.564	.25	47,000	61,240	29.8	67.8	do	.19, .25, .33, .59*, .24, .19
4425	86	O. H. steel No. 6	.564	.25	48,000	61,760	27.7	67.8	do	.18, .20, .23, .57*, .27, .21
4426	87	O. H. steel No. 7	.564	.25	48,000	64,080	30.3	67.8	do	.19, .26, .35, .59*, .24, .19
4427	88	O. H. steel No. 7	.564	.25	47,000	64,160	28.0	65.8	do	.19, .22, .31, .54*, .23, .19
4428	89	O. H. steel No. 7	.594	.25	47,000	64,160	29.3	67.8	do	.19, .47*, .42*, .23, .23, .22
4429	90	O. H. steel No. 7	.564	.25	44,000	63,400	28.8	67.8	do	.19, .23, .28, .59*, .25, .19
4434	47	Wrought iron No. 2	.564	.25	32,000	54,200	25.2	41.9	Fibrous, lamellar	.18, .23, .31, .37*, .22, .20
4435	61	Wrought iron No. 4	.564	.25	32,000	51,240	28.3	49.7	Fibrous	.20, .23, .33, .46*, .25, .23
4436	62	Wrought iron No. 4	.564	.25	32,000	52,200	24.7	47.2	do	.19, .26, .46*, .22, .18, .17
4437	63	Wrought iron No. 4	.564	.25	33,000	53,960	25.2	44.6	do	.17, .18, .20, .22, .30, .44*
4438	64	Wrought iron No. 4	.564	.22	30,000	50,600	26.0	44.6	do	.21, .20, .20, .44*, .31, .20
4439	69	Wrought iron No. 5	.564	.25	35,000	54,560	23.5	36.4	Fibrous, lamellar	.27 .39*, .21, .18, .18, .18
4441	93	Wrought iron No. 6	.564	.25	35,000	47,000	27.0	47.2	Fibrous	.43, .26, .26, .25, .23, .19
4442	94	Wrought iron No. 6	.564	.25	35,000	47,040	28.0	49.7	do	.27, .47*, .25, .25, .22, .22
4443	94	Wrought iron No. 6	.564	.25	34,000	46,440	24.7	44.6	do	.21, .25, .43*, .20, .20, .19
4444	95	Wrought iron No. 6	.564	.25	35,000	46,840	27.3	49.7	do	.19, .30, .48*, .25, .23, .19
4440	92	Wrought iron No. 7	.564	.25	34,000	47,560	28.0	44.6	do	.23, .27, .47*, .26, .25, .20
4448	100	Wrought iron No. 8	.564	.25	35,000	49,360	28.7	54.6	do	.33, .49*, .26, .33, .22, .19
4449	101	Wrought iron No. 8	.564	.25	36,000	50,000	28.7	52.2	do	.19, .22, .25, .27, .52*, .27
4450	102	Wrought iron No. 8	.564	.25	35,000	50,520	31.3	49.7	do	.23, .30, .55*, .30, .27, .23
4451	108	Wrought iron No. 8	.564	.25	36,000	49,680	27.2	47.2	Fibrous, lamellar	.19, .23, .47*, .30, .23, .21
4452	109	Wrought iron No. 8	.564	.25	35,000	49,680	29.5	49.7	Fibrous	.21, .25, .27, .56* .27, .21
4445	96	Wrought iron No. 9	.564	.25	31,000	45,680	27.5	44.6	Fibrous, lamellar	,21, .28, .28, .43*, .25, .20
4446	97	Wrought iron No. 9	.564	.25	35,000	46,080	29.5	44.6	Fibrous	.23, .27, .52*, .29, .25, .21
4447	98	Wrought iron No. 9	.564	.25	35,000	45,440	23.5	47.2	Fibrous, seamy	.47*, .21, .21, .19, .17, .16

CHAIN CABLE.

TENSILE TESTS OF CHAIN CABLE, AND SWIVELS, AND SHACKLES, FOR UNITED STATES LIGHT-HOUSE INSPECTOR THIRD DISTRICT, TOMPKINSVILLE, N. Y.

[Chain samples consist of three studded links, with unstudded end links.]

No. of test.	Marks.	Diameters.		Sectional area of chain.	Tensile strength.		Fractures.
		End links.	Studded links.		Total.	Per square inch.	
		Inches.	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	
5167	"W. L. R. M. Co., Lebanon, Pa."	2.37	2.13	7.13	259,200	36,350	Middle link of chain in the quarter at end of weld. Fibrous, in part granular.
4833	J. B. C. & Co., proved.	2.12	2.02	6.41	225,100	35,120	First link at the weld. Fibrous.
4834	....do	2.12	2.02	6.41	214,700	33,490	First link at the weld. In part fibrous, part granular. Separated along scarf.
4835	....do	2.12	2.03	6.47	253,300	39,150	First link at the quarter, opposite side from weld. Fibrous. Started an opening along the scarf.
4836	....do	2.13	2.03	6.47	257,900	39,860	Middle link at weld. In part fibrous, balance followed the scarf.
4837	....do	2.12	2.04	6.54	278,400	42,570	End link at the weld and opposite end. Studded links not fractured.
4838	....do	2.13	2.03	6.47	220,900	34,140	First link at the weld, Followed scarf, which had a dark-colored surface.
4839	....do	2.13	2.03	6.47	226,300	34,980	Middle link at the weld. Fibrous, in part following the scarf.
4840	....do	2.13	2.01	6.35	247,700	39,010	.....do.....
4842	....do	2.13	2.03	6.47	253,400	39,170	First link of the chain at weld and opposite end. Granular.
4889	....do	2.00	2.00	6.28	243,100	38,710	First link of the chain at weld. Followed the scarf.
4890	....do	2.12	2.00	6.28	268,910	42,820	Middle link of chain, end opposite the weld. Fibrous.
4891	....do	2.12	2.00	6.28	274,500	43,710	First studded link at the weld. Fibrous.
4892	....do	2.02	2.02	6.41	241,300	37,640	Middle link at the weld. Fibrous, in part following the scarf.
5315	....do	2.14	2.00	6.28	233,280	37,150	First studded link at the weld. Followed scarf in part, and in part granular.
5316	....do	2.15	2.03	6.47	227,300	35,130	Middle link at the weld. Followed the scarf
5317	....do	2.15	2.02	6.41	225,200	35,130	End link at weld. Followed scarf. Studded links not fractured.
5318	....do	2.15	2.00	6.28	190,700	30,370	Middle link at weld. Followed the scarf.
5319	....do	2.15	2.00	6.28	201,300	32,050	End link at the weld. Followed the scarf in part, and in part granular.
5320	....do	2.15	2.00	6.28	250,600	39,900	First studded link at weld. Followed the scarf in part, and in part fibrous.
5321	....do	2.15	2.02	6.41	204,900	31,970	First studded link at the weld. Followed the scarf and in part fibrous.
5322	....do	2.15	2.00	6.28	247,100	39,350	Middle link at the weld. Followed the scarf, and in part fibrous with some granulation.
5378	....do	2.15	2.00	6.28	251,600	40,060	First studded link at the weld. Fibrous 90 per cent, granular 10 per cent.
5379	....do	2.15	2.00	6.28	228,800	36,430	First studded link at the weld. Fibrous, in part following the scarf.
5380	....do	2.15	2.00	6.28	251,700	40,080	End link. Followed the scarf.
5381	....do	2.12	2.00	6.28	250,700	39,920	Middle studded link at the welded end. Fractured in two places, a piece of the end of the link being detached. Granular, in part fibrous.
4841	....do	2.02	1.89	5.61	231,500	41,270	Middle link at the weld. Fibrous, in part following the scarf.
4843	....do	2.03	1.88	5.55	231,900	41,780	Middle link at the weld. Followed the scarf.

TENSILE TESTS OF CHAIN CABLE, AND SWIVELS, ETC.—Continued.

No. of test.	Marks.	Diameters.		Sectional area of chain.	Tensile strength.		Fractures.
		End links.	Studded links.		Total.	Per square inch.	
		Inch.	*Inch.*	*Sq. In.*	*Pounds.*	*Pounds.*	
4901	J. B. C. & Co., Proved.	1.88	1.88	5.55	232,900	41,960	End link at the weld. Studded links not fractured.
5382	....do	2.00	1.88	5.55	214,800	38,700	End link. Followed the scarf.
5383	....do	2.00	1.88	5.55	219,980	39,640	....do
5384	....do	2.00	1.88	5.55	207,870	37,450	....do
5385	....do	2.00	1.88	5.55	167,900	30,250	....do
5386	....do	2.00	1.88	5.55	219,680	39,580	Middle link at welded end. Fibrous.
5387	....do	2.00	1.88	5.55	206,500	37,210	Middle link. Followed the scarf in part and in part fibrous.
5388	....do	2.00	1.88	5.55	139,300	25,100	End link. Followed the scarf.
5389	....do	2.00	1.88	5.55	214,070	38,570	....do
4844	J. B. C. & Co., Proved.	1.90	1.78	4.98	203,500	40,860	Middle link on the side opposite the weld. Fibrous.
4872	....do	1.87	1.78	4.98	214,700	43,110	First studded link, pulled out a piece about 3″ across at welded end. One end of piece, granular; the other, fibrous.
4873	....do	1.84	1.76	4.86	178,900	36,810	First studded link at end of weld. Fibrous, 95 per cent; granular, 5 per cent.
4874	....do	1.87	1.78	4.98	186,100	37,370	End link. Followed the scarf.
4875	....do	1.85	1.78	4.98	213,250	42,820	First studded link, end opposite the weld. Fibrous.
4876	....do	1.87	1.75	4.81	196,280	40,810	Middle link at the weld. Followed the scarf.
4877	....do	1.86	1.76	4.86	207,390	42,670	End link at weld.
4845	J. B. C. & Co., Proved.	1.78	1.61	4.07	166,800	40,980	First link at the end of scarf. Fibrous.
4847	....do	1.78	1.62	4.12	158,950	38,580	First link at the weld. Fibrous.
4848	....do	1.78 1.62	1.62	4.12	162,500	39,440	The smaller end link. Chain not fractured.
4849	....do	1.78	1.62	4.12	153,100	37,160	Middle link at end of scarf. Fibrous.
4850	....do	1.78	1.62	4.12	170,200	41,310	Middle link at end of weld. Fibrous. Also opened weld at other end of scarf.
4851	....do	1.78	1.62	4.12	175,600	42,620	First link at end of scarf. Fibrous.
4852	....do	1.78	1.62	4.12	172,500	41,870	....do
4893	....do	1.78	1.60	4.02	176,950	44,020	Middle link in the vicinity of weld. Fibrous, 50 per cent; granular, 50 per cent.
4894	....do	1.60	1.60	4.02	173,500	43,160	First studded link at weld. Fibrous.
4846	J. B. C. & Co., Proved.	1.62	1.47	3.39	153,700	45,340	First link near the end of scarf. Fibrous.
4878	....do	1.60	1.45	3.30	120,800	36,610	Middle link at weld. Followed scarf in part, part fibrous, 10 per cent granular.
4879	....do	1.61	1.46	3.34	141,100	42,250	First studded link at weld. Followed scarf.
4880	....do	1.60	1.48	3.44	144,480	42,000	Middle link at weld. Fibrous.
4902	....do	1.50	1.50	3.53	151,600	42,950	End link at weld. Studded links not fractured.
4853	J. B. C. & Co., Proved.	1.22 1.17	1.12	1.97	82,480	41,870	First link. Followed scarf.
4881	....do	1.23	1.12	1.97	82,650	41,950	End link at weld. Fibrous.
4882	....do	1.22	1.12	1.97	85,890	43,600	First studded link at weld. Fibrous.

TESTS OF SWIVELS AND SHACKLES.

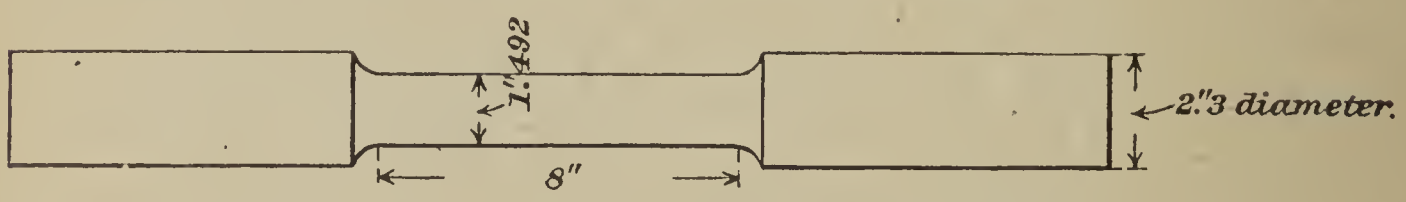
No. of test.	Description.	Tensile strength.	Fractured.
		Pounds.	
4859	Swivel for 2″ chain	112,900	Eye of male part. Granular.
5323	....do	179,900	Pulled off head of male part. Fibrous, slightly granular.
5391	....do	136,200	Pulled off head of male part. Fibrous. This swivel had a $\frac{5}{8}$″ pin through stem.
4865	Shackle for 2″ chain	238,400	Sheared the tongue.
4895	....do	306,500	Tongue of shackle.
5324	....do	297,600	Do.
5390	....do	322,600	Bale of shackle. Fibrous.
4858	Swivel for $1\frac{7}{8}$″ chain	127,200	Eye of male part. Granular.
5392	....do	162,500	Pulled off head of male part. Fibrous.
4864	Shackle for $1\frac{7}{8}$″ chain	276,400	Sheared the tongue.
4857	Swivel for $1\frac{3}{4}$″ chain	84,900	Eye of male part. Granular.
4863	Shackle for $1\frac{3}{4}$″ chain	208,200	Across eye through pin hole for holding tongue in place. Fibrous.
4856	Swivel for $1\frac{5}{8}$″ chain	92,900	Eye of male part. Granular.
4862	Shackle for $1\frac{5}{8}$″ chain	222,050	Sheared the tongue.
4855	Swivel for $1\frac{1}{2}$″ chain	95,700	Eye of male part at the weld.
4861	Shackle for $1\frac{1}{2}$″ chain	192,500	Sheared the tongue.
4854	Swivel for $1\frac{1}{8}$″ chain	57,100	Eye of male part at the weld.
4860	Shackle for $1\frac{1}{8}$″ chain	114,800	Across eye through pin hole for holding tongue in place. Fibrous.

TENSILE TESTS OF CHAIN CABLE AND IRON USED IN CABLE, FOR CAPT. THOS. O. SELFRIDGE, U. S. N., BOSTON NAVY-YARD.

[Samples consist of three studded links with unstudded end links. Studs of chain branded "U. S.," "N. Y. B."

No. of test.	Diameters. End links.	Diameters. Studded links.	Sectional area of chain.	Tensile strength. Total.	Tensile strength. Per square inch.	Fractured.
	Inches.	*Inches.*	*Sq. Inch.*	*Pounds.*	*Pounds.*	
4898	2.35	2.25	7.95	292,950	36,850	First studded link at the weld. Followed the scarf in part, and in part granular.
4899	1.88	1.78	4.98	173,800	34,900	First studded link at the weld. Followed scarf. Granular at circumference 10 per cent.
4900	1.38	1.25	2.45	75,600	30,860	End link at the weld. Studded links not fractured.

SAMPLE OF IRON USED IN CHAIN.



Rolled bar turned down at middle.
Diameter, 1″.492.
Sectional area, 1.75 square inches.
Elastic limit 38,200 pounds = 21,830 pounds per square inch.
Tensile strength 85,170 pounds = 48,670 pounds per square inch.
Elongation in 8 inches, 2″.33 = 29.1 per cent.
Elongation of inch sections: ″.18, ″.30, ″.58*, ″.35, ″.27, ″.26, ″.23, ″.16.
Diameter at fracture, 1″.18; area, 1.09 square inches; contraction of area, 37.7 per cent.
Appearance of fracture, fibrous.

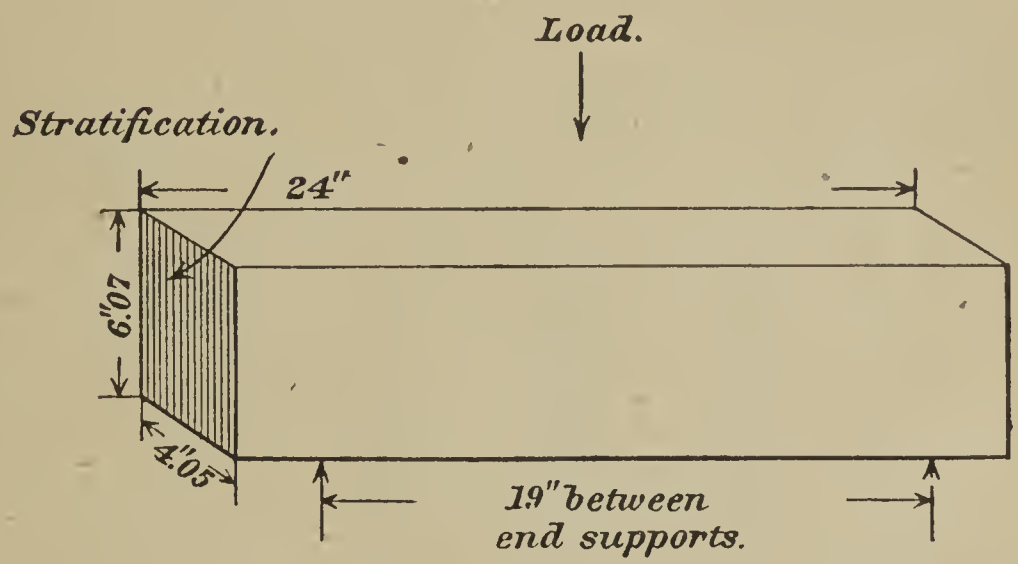
NATURAL STONES.

TRANSVERSE, SHEARING AND COMPRESSION TESTS.

TRANSVERSE TESTS DETAILS.

No. 5023.

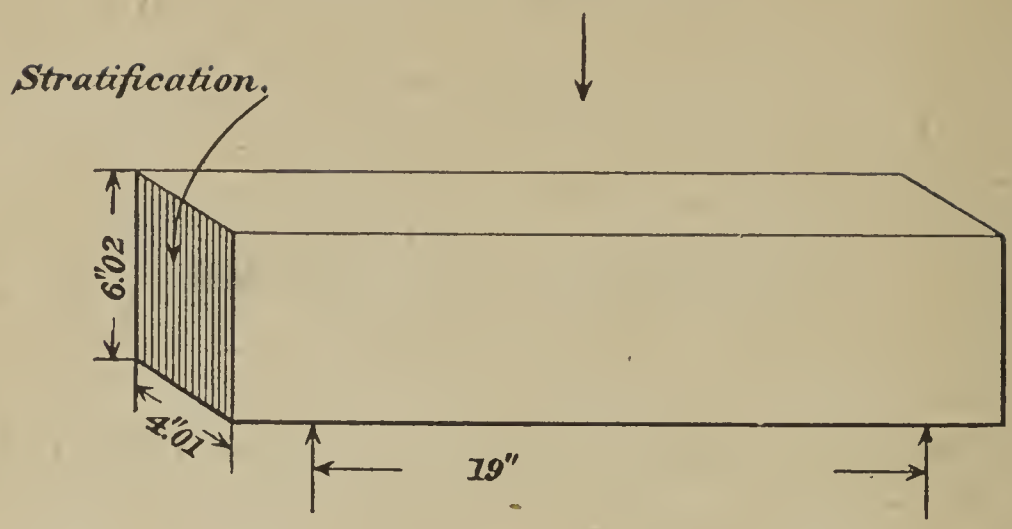
HOOSIER BUFF OOLITIC LIMESTONE FROM BEDFORD, IND.



Applied loads.		Deflections.	Successive deflections.	Deflection. sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
200	.....	0.	0.	0.	Initial load.
1,000	.....	.0010	.0010	.0001	
1,200	.....	.0013	.0003	.....	
1,600	.....	.0016	.0003	.....	
2,000	.....	.0019	.0003	.0003	
2,400	.....	.0023	.0004	.....	
2,800	.....	.0027	.0004	.0007	
3,000	.....	.0028	.0001	.....	
3,200	.....	.0030	.0002	.....	
3,400	.....	.0032	.0002	.....	
3,600	.....	.0032	0.	.....	
3,800	.....	.0035	.0003	.....	
4,000	.....	.0036	.0001	.0006	
4,200	.....	.0037	.0001	.....	
4,400	.....	.0038	.0001	.....	
4,600	.....	.0040	.0002	.....	
4,800	.....	.0041	.0001	.....	
5,000	.....	.0043	.0002	.0006	
5,200	.....	.0045	.0002	.....	
5,400	.....	.0046	.0001	.....	
5,600	.....	.0048	.0002	.....	
5,800	.....	.0049	.0001	.....	
6,000	.....	.0050	.0001	.0007	
6,200	.....	.0052	.0002	.....	
6,400	.....	.0053	.0001	.....	
6,600	.....	.0055	.0002	.....	
6,800	.....	.0056	.0001	.....	
7,000	.....	.0057	.0001	.....	
7,200	.....	.0058	.0001	.....	
7,400	.....	.0060	.0002	.0007	
7,600	.....	.0062	.0002	.....	
8,000	.....	.0065	.0003	.....	
8,380	1,601	.....	.....	.....	Ultimate strength.

No. 5024.

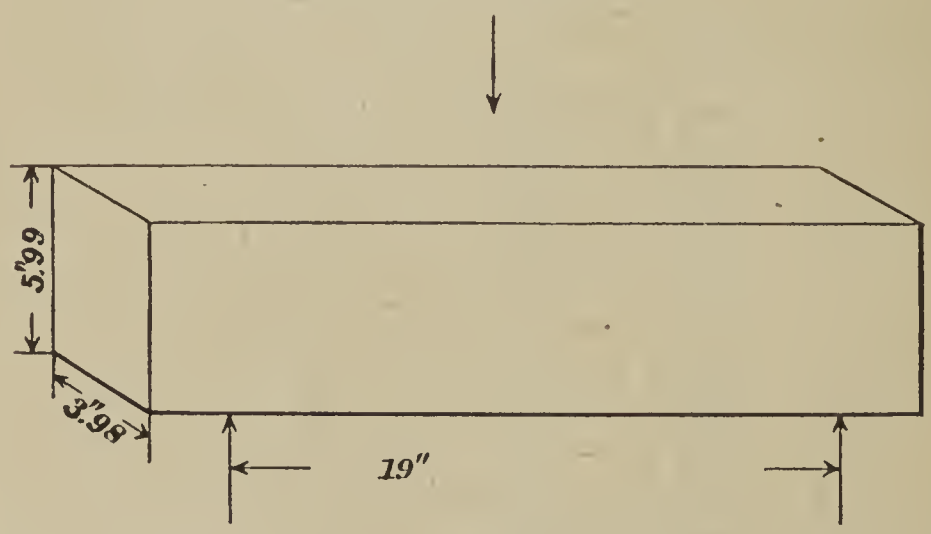
INDIANA LIMESTONE.



Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
200	.....	0.	0.	0.	Initial load.
600	.....	.0010	.0010	.....	
1,000	.....	.0017	.0007	.0005	
1,400	.....	.0022	.0005	.....	
1,800	.....	.0028	.0006	.....	
2,000	.....	.0031	.0003	.0006	
2,400	.....	.0037	.0006	.....	
2,800	.....	.0041	.0004	.....	
3,000	.....	.0043	.0002	.0008	
3,400	.....	.0048	.0005	.....	
3,800	.....	.0053	.0005	.....	
4,000	.....	.0056	.0003	.0010	
4,810	943	.....	.....	.....	Ultimate strength.

No. 5025.

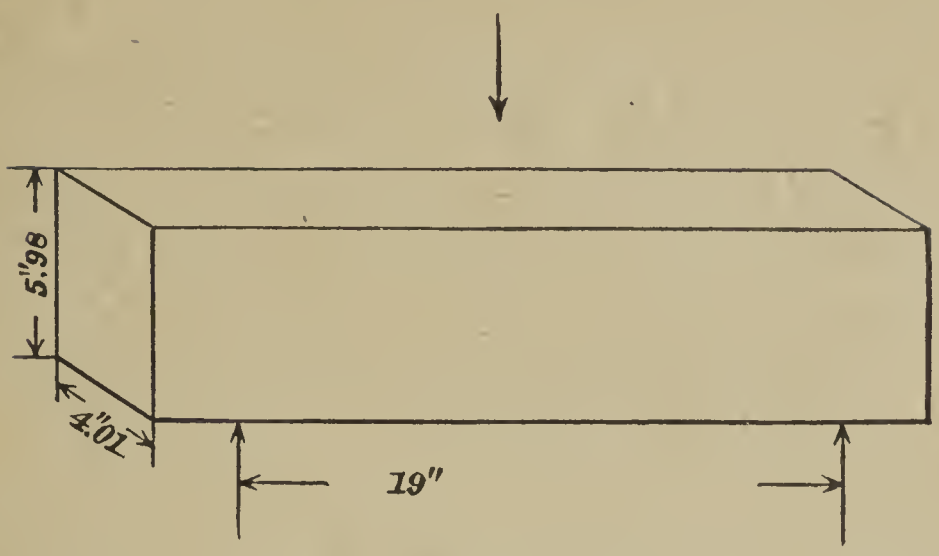
VERMONT MARBLE.



Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
200	.....	0.	0.	0.	Initial load.
1,000	.....	.0008	.0008	.0001	
2,000	.....	.0016	.0008	.0002	
3,000	.....	.0023	.0007	.0003	
4,000	.....	.0030	.0007	.0005	
5,000	.....	.0036	.0006	.....	
6,000	.....	.0041	.0005	.0005	
7,000	.....	.0049	.0008	.....	
7,670	1,531	.....	.....	.....	Ultimate strength.

No. 5026.

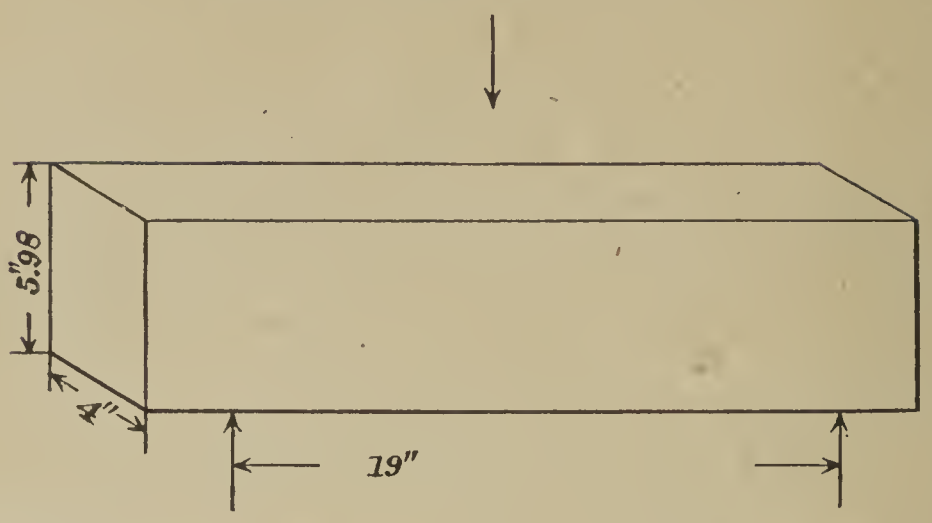
LEE MARBLE.



Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
200	.....	0.	0.	0.	Initial load.
1,000	.....	.0011	.0011	.0001	
2,000	.....	.0025	.0014	.0003	
3,000	.....	.0035	.0010	.0005	
4,000	.....	.0047	.0012	.0008	
5,000	.....	.0058	.0011	.0010	
6,000	.....	.0069	.0011	.0011	
7,000	.....	.0083	.0014	.0015	
7,980	1,586	.....	.....	.....	Ultimate strength.

No. 5027.

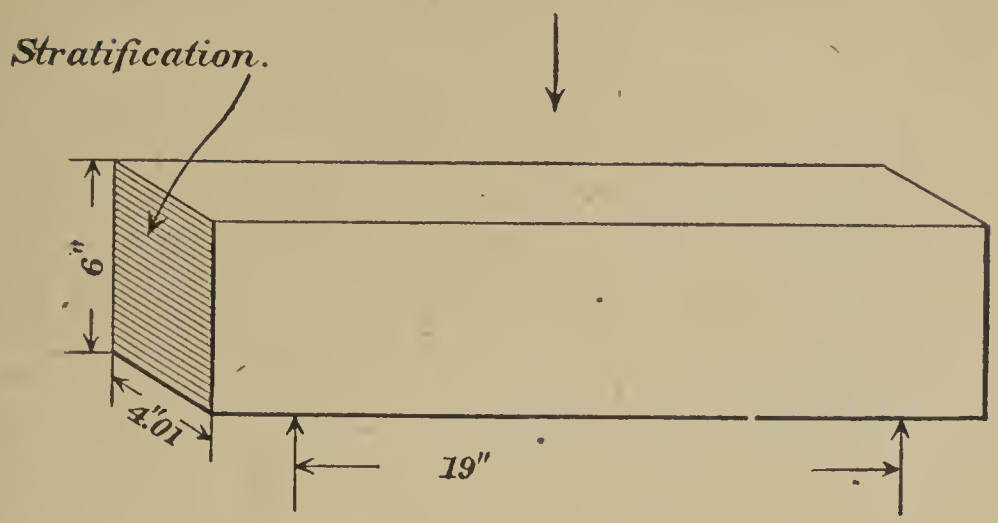
POTOMAC RED SANDSTONE.



Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
200	.....	0.	0.	0.	Initial load.
1,000	.....	.0010	.0010	.0001	
2,000	.....	.0023	.0013	.0003	
3,000	.....	.0033	.0010	.0003	
4,000	.....	.0043	.0010	.0005	
5,000	.....	.0051	.0008	.....	
6,000	.....	.0060	.0009	.0007	
7,000	.....	.0070	.0010	.....	
8,000	.....	.0078	.0008	.0009	
9,000	.....	.0086	.0008	.....	
10,000	.....	.0095	.0009	.0012	
11,000	.....	.0103	.0008	.....	
12,000	.....	.0111	.0008	.0015	
13,000	.....	.0122	.0011	.....	
14,000	.....	.0130	.0008	.0017	
15,000	.....	.0140	.0010	.....	
15,100	3,009	.....	.....	.....	Ultimate strength.

No. 5028.

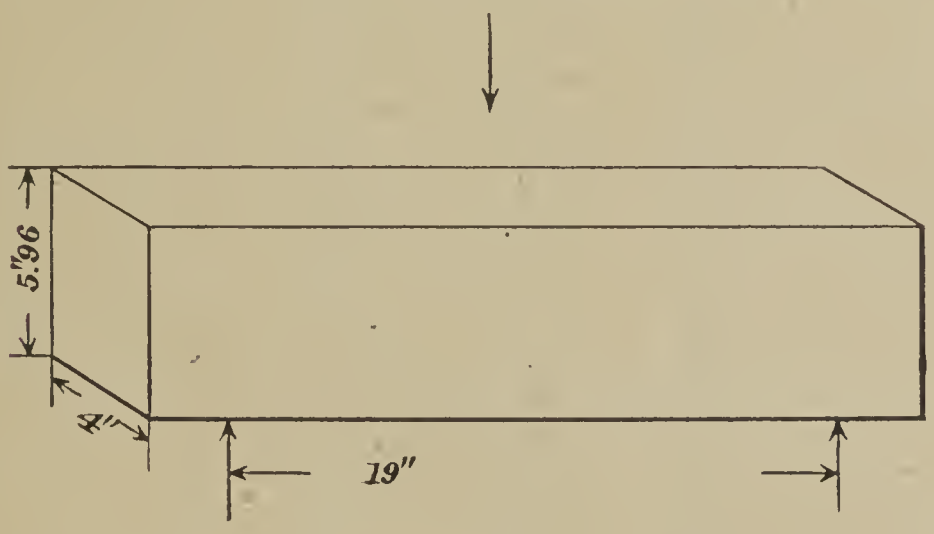
PORTLAND (CONN.) RED SANDSTONE.



Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
200	.....	0.	0.	0.	Initial load.
1,000	.....	.0021	.0021	.0006	
2,000	.....	.0042	.0021	.0010	
3,000	.....	.0060	.0018	.0015	
4,000	.....	.0077	.0017	.0020	
5,000	.....	.0095	.0018	.0025	
6,000	.....	.0115	.0020	.0032	
7,000	.....	.0137	.0022	.0039	
7,985	1,576	.....	.....	.....	Ultimate strength.

No. 5029.

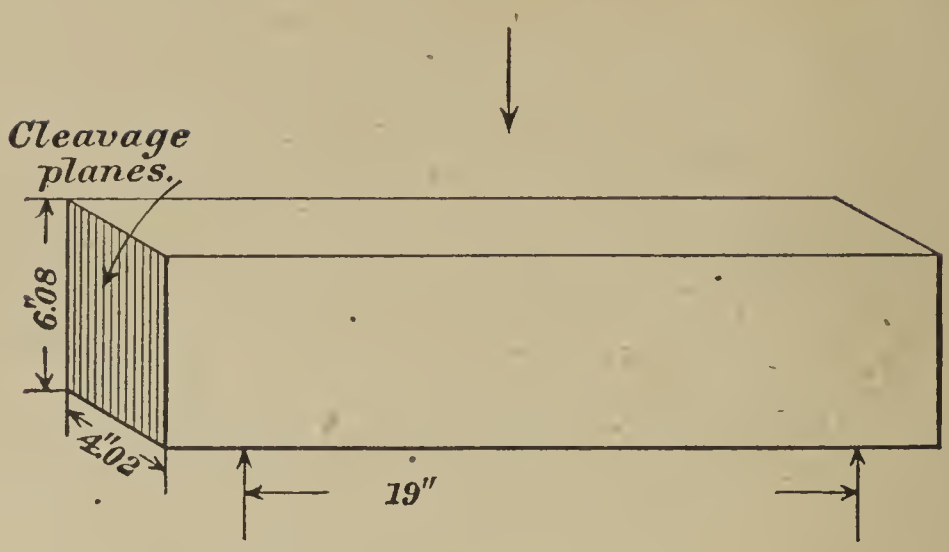
OHIO SANDSTONE.



Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
200	.....	0.	0.	0.	Initial load.
1,000	.....	.0050	.0050	.0018	
2,000	.....	.0123	.0083	.0039	
3,000	.....	.0188	.0065	.0065	
3,860	774	.....	.....	.....	Ultimate strength.

No. 5030.

Monson (Me.) Slate.

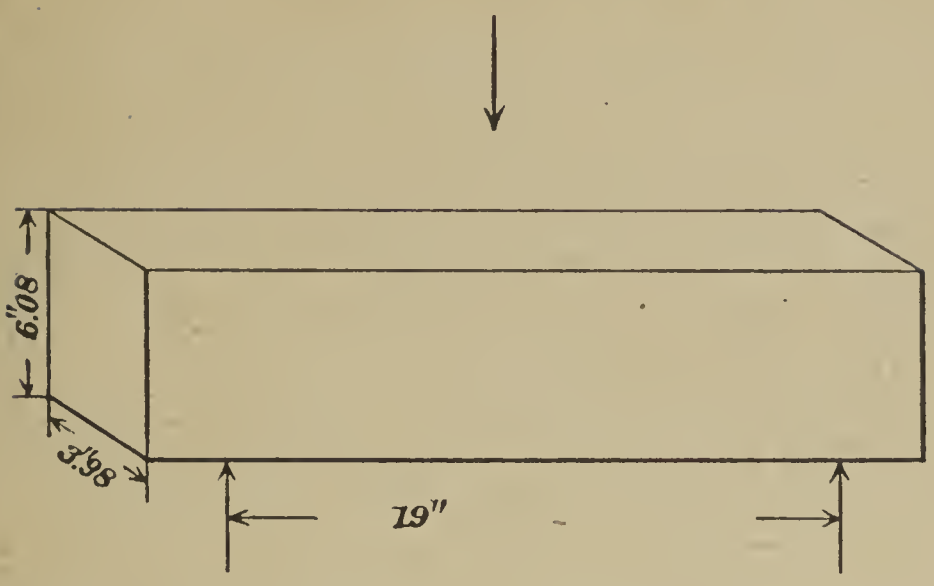


Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
200	.....	0.	0.	0.	Initial load.
1,000	.....	.0008	.0008	0.	
2,000	.....	.0015	.0007	0.	
3,000	.....	.0020	.0005	.....	
4,000	.....	.0025	.0005	.0002	
5,000	.....	.0029	.0004	.....	
6,000	.....	.0032	.0003	.0003	
7,000	.....	.0035	.0003	.....	
8,000	.....	.0038	.0003	.....	
9,000	.....	.0042	.0004	.....	
10,000	.....	.0045	.0003	.0003	
11,000	.....	.0048	.0003	.....	
12,000	.....	.0051	.0003	.....	
13,000	.....	.0053	.0002	.....	
14,000	.....	.0056	.0003	.0003	
15,000	.....	.0060	.0004	.....	
16,000	.....	.0063	.0003	.....	
17,000	.....	.0066	.0003	.....	
18,000	.....	.0068	.0002	.0004	
19,000	.....	.0071	.0003	.....	
20,000	.....	.0073	.0002	.0004	
21,000	.....	.0077	.0004	.....	
22,000	.....	.0080	.0003	.....	
23,000	.....	.0083	.0003	.....	
24,000	.....	.0085	.0002	.0006	
25,000	.....	.0088	.0003	.....	
26,000	.....	.0090	.0002	.....	
27,000	.....	.0093	.0003	.....	
28,000	.....	.0097	.0004	.0006	
29,000	.....	.0099	.0002	.....	
30,000	.....	.0102	.0003	.0007	
31,000	.....	.0105	.0003	.....	
32,000	.....	.0107	.0002	.....	
33,000	.....	.0110	.0003	.....	
34,000	.....	.0112	.0002	.0004	
35,000	.....	.0114	.0002	.....	
36,000	.....	.0117	.0003	.....	
37,000	.....	.0120	.0003	.....	
38,000	.....	.0122	.0002	.....	
39,000	.....	.0126	.0004	.....	
40,000	7,671	.0128	.0002	.....	Ultimate strength.

Sustained maximum load one-half minute, then fractured.

No. 5031.

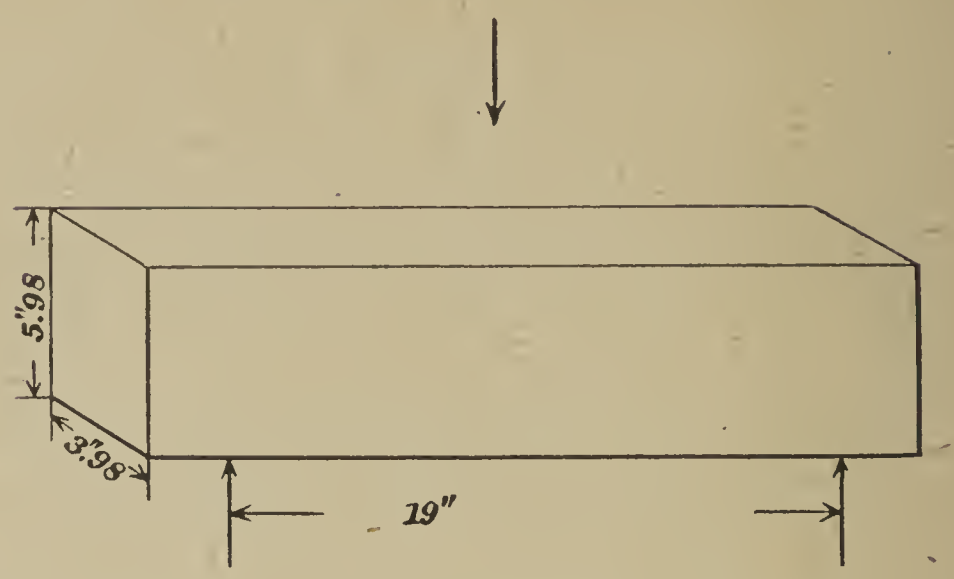
North River Bluestone.



Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
200	.....	0.	0.	0.	Initial load.
1,000	.....	.0017	.0017	.0005	End bearings are convex.
2,000	.....	.0030	.0013	.0006	
3,000	.....	.0041	.0011	.....	
4,000	.....	.0049	.0008	.....	
5,000	.....	.0056	.0007	.....	
6,000	.....	.0062	.0006	.0010	
7,000	.....	.0069	.0007	.....	
8,000	.....	.0073	.0004	.....	
9,000	.....	.0078	.0005	.....	
10,000	.....	.0082	.0004	.0013	
11,000	.....	.0088	.0006	.....	
12,000	.....	.0092	.0004	.....	
13,000	.....	.0097	.0005	.....	
14,000	.....	.0101	.0004	.0014	
15,000	.....	.0105	.0004	.....	
16,000	.....	.0110	.0005	.....	
17,000	.....	.0115	.0005	.....	
18,000	.....	.0118	.0003	.0016	
19,000	.....	.0123	.0005	.....	
20,000	.....	.0128	.0005	.0017	
21,000	.....	.0133	.0005	.....	
22,000	.....	.0137	.0004	.....	
23,000	.....	.0140	.0003	.....	
24,000	.....	.0145	.0005	.0020	
25,000	.....	.0148	.0003	.....	
26,000	.....	.0153	.0005	.....	
27,000	.....	.0158	.0005	.....	
28,000	.....	.0162	.....	.0020	
29,000	5,618	.....	.....	.....	Ultimate strength.

No. 5032.

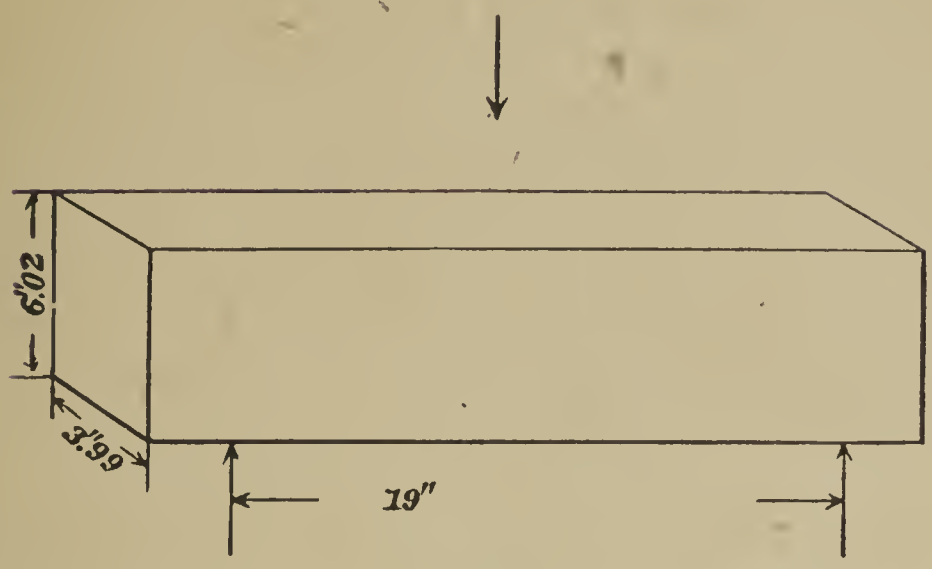
WORCESTER GRANITE.



Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
200	.....	0.	0.	0.	Initial load.
1,000	.....	.0018	.0018	.0002	
2,000	.....	.0037	.0019	.0003	
3,000	.....	.0051	.0014	.....	
4,000	.....	.0064	.0013	.0010	
5,000	.....	.0073	.0009	.....	
6,000	.....	.0082	.0009	.0010	
7,000	.....	.0092	.0010.	.....	
8,000	.....	.0101	.0009	.0015	
9,000	.....	.0110	.0009	.....	
10,000	.....	.0119	.0009.	.0018	
11,000	.....	.0130	.0011	.....	
11,950	2,393	.....	.....	.....	Ultimate strength.

No. 5033.

QUINCY GRANITE



Applied loads.		Deflections.	Successive deflections.	Deflection sets.	Remarks.
Total.	Maximum fiber stress.				
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
200	.....	0.	0.	0.	Initial load.
1,000	.....	.0029	.0029	.0011	
2,000	.....	.0052	.0023	.0017	
3,000	.....	.0069	.0017	.0020	
4,000	.....	.0083	.0014	.0026	
5,000	.....	.0092	.0009	.....	
6,000	.....	.0102	.0010	.0027	
7,000	.....	.0115	.0013	.....	
8,000	.....	.0123	.0008	.0033	
9,000	.....	.0135	.0012	.....	
10,000	.....	.0144	.0009	.0037	
10,810	2,131	.....	.....	.....	Ultimate strength.

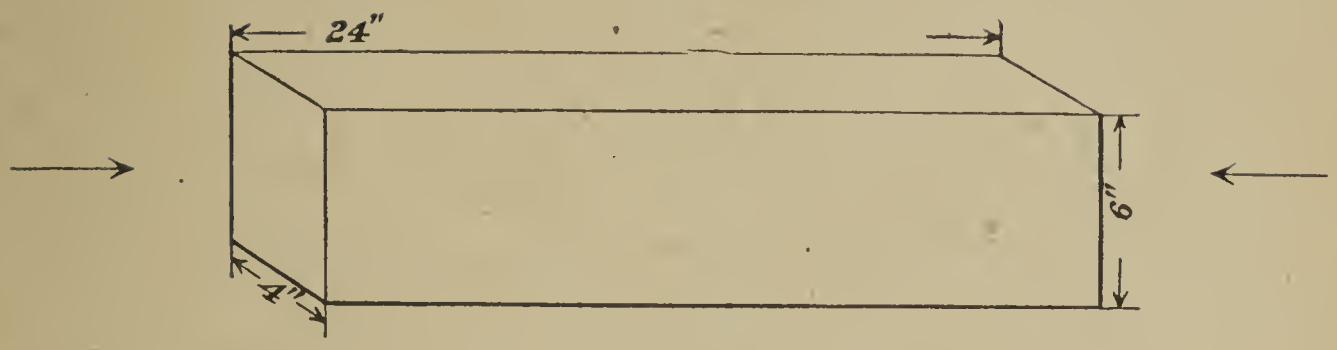
TABULATION OF TRANSVERSE TESTS OF NATURAL STONES.

No. of test.	Kind of stone.	Dimensions.			Distance between end supports.	Ultimate strength.		Remarks.
		Length.	Breadth.	Depth.		Total.	Maximum fiber stress per square inch.	
		Inches.	*Inches.*	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
5023	Hoosier buff limestone	24	4.05	6.07	19	8,380	1,601	
5024	Indiana limestone	24	4.01	6.02	19	4,810	943	
5025	Vermont marble	24	3.98	5.99	19	7,670	1,531	
5026	Lee marble	24	4.01	5.98	19	7,980	1,586	
5027	Potomac red sandstone	24	4.00	5.98	19	15,100	3,009	
5028	Portland red sandstone	24	4.01	6.00	19	7,985	1,576	
5029	Ohio sandstone	24	4.00	5.96	19	3,860	774	
5030	Monson slate	24	4.02	6.08	19	40,000	7,671	Sustained maximum load ½ minute, then fractured.
5031	North River bluestone	24	3.98	6.08	19	29,000	5,618	End bearings are convex.
5032	Worcester granite	24	3.98	5.98	19	11,950	2,393	
5033	Quincy granite	24	3.99	6.02	19	10,810	2,131	

No. 5022.

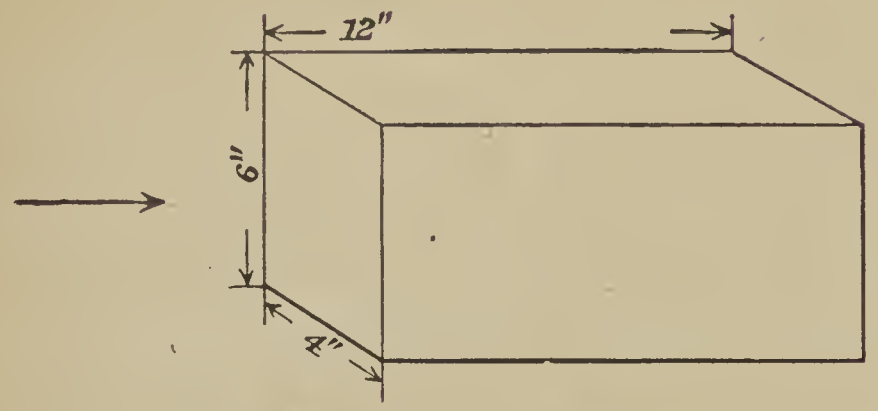
Quincy Granite.

COMPRESSION TEST.



Sectional area, 24 square inches.
Gauged length, 20″.

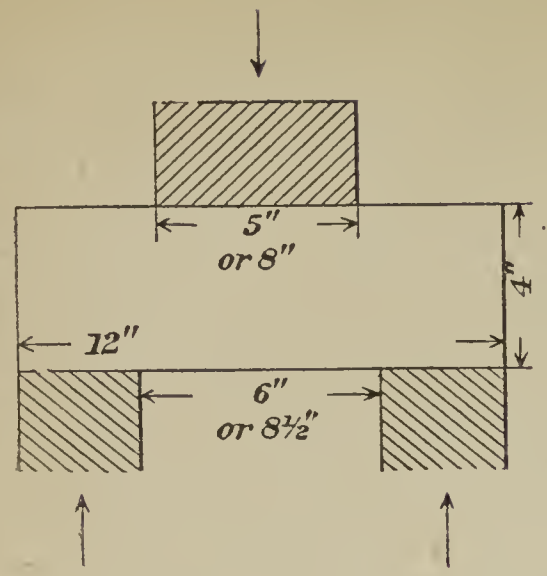
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,400	100	0.	0.	Initial load.
24,000	1,000	.0037	.0004	
48,000	2,000	.0069	.0006	
72,000	3,000	.0097	.0007	
96,000	4,000	.0117	.0008	
120,000	5,000	.0148	.0010	
144,000	6,000	.0173	.0011	
168,000	7,000	.0197	.0012	
172,000	7,170	.....	.0012	Cracked.
24,000	1,000	.0051	.....	
48,000	2,000	.0081	.....	
72,000	3,000	.0107	.....	
96,000	4,000	.0130	.....	
120,000	5,000	.0154	.....	
96,000	4,000	.0133	.....	
72,000	3,000	.0112	.....	
48,000	2,000	.0088	.....	
24,000	1,000	.0059	.0014	
48,000	2,000	.0080	.....	
484,200	20,175	.....	.....	Ultimate strength.



Specimens tested on bed, except the bluestone and the slate, which were tested on edge.

The ends were faced with plaster of Paris, to secure even bearings in testing machine.

No. of test.	Kind of stone.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
5089	Hoosier buff limestone	12.00	6.01	4.01	24.1	164,000	171,200	7,104	
5090	Indiana limestone	12.00	6.00	4.02	24.1	166,700	179,300	7,440	
5091	Vermont marble	12.02	5.99	4.00	24.0	287,700	287,700	11,987	
5092	Lee marble	11.99	5.88	3.98	23.4	422,300	422,300	18,047	
5093	Potomac red sandstone	11.97	6.00	4.01	24.1	458,500	458,700	19,033	
5094	Portland red sandstone	12.02	6.00	3.97	23.8	239,800	253,600	10,655	
5095	Ohio sandstone	12.00	5.99	3.98	23.8	202,900	206,100	8,660	
5096	Monson slate	12.00	6.06	4.05	24.5	160,000	478,000	19,510	
5097	North River bluestone	12.08	6.02	3.93	23.7	608,000	608,000	25,654	
5098	Worcester granite	12.02	6.01	4.01	24.1	608,100	608,100	25,232	
5099	Quincy granite	12.03	6.00	4.00	24.0	134,000	462,800	19,283	The tests of these specimens were characterized by a succession of pieces flaking off after the first cracks were observed to appear.
5100	Cape Ann granite	11.93	6.00	4.00	24.0	173,000	487,100	20,296	



The area of both end supports was 36 square inches, and the area of bearing of plunger 30 square inches in all cases, excepting No. 5096, where the areas were 21 square inches and 48 square inches, respectively.

The bearing surfaces of all specimens, excepting Nos. 5096, 5097, and 5099, were faced with plaster of Paris.

No. of test.	Kind of stone.	Shearing dimensions.		Shearing area.	First crack.	Shearing strength.		Fractures.
						Total.	Per square inch.	
		Inches.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
5096	Hoosier buff limestone	4.03	6.03	48.6	51,800	51,800	1,066	Good shearing fractures, cracked at middle of length.
5097	Indiana limestone	4.00	6.00	48.0	19,000	29,200	608	End bearings not considered good.
5098	Do	4.00	6.00	48.0	10,900	55,400	1,154	Crack at middle of length. Sheared ends.
5099	Vermont marble	4.00	6.00	48.0	33,100	33,100	690	End bearings not considered good. Cracked at middle of length, ends sheared separately into four pieces.
5100	Do	3.98	6.00	47.7	20,100	88,100	1,847	Cracked at middle of length. Sheared ends.
5101	Lee marble	4.00	6.01	48.1	83,200	98,700	2,052	Do.
5102	Potomac red sandstone	4.03	6.02	48.5	111,200	111,200	2,293	Several reports of fractures immediately preceded complete rupture. Ends sheared, cracked at middle of length.
5103	Portland red sandstone	4.00	6.00	48.0	66,800	66,800	1,392	Sheared ends, cracked near middle of length at porous strata.
5104	Ohio sandstone	4.01	6.00	48.1	43,580	43,580	906	Good shearing fractures, cracked at middle of length.
5105	Monson slate	4.00	6.10	48.8	91,800	107,000	2,192	Irregular tensile fractures. Stone did not shear.
5106	North River bluestone	3.98	5.98	47.6	43,100	147,900	3,107	Crack opened at middle of length, sheared one end.
5107	Worcester granite	4.01	6.04	48.4	102,380	114,200	2,359	Crack opened at middle of length, sheared ends. Several reports immediately preceding rupture.
5108	Quincy granite	4.06	6.01	48.8	52,000	114,900	2,355	Crack opened at middle of length, sheared ends.
5109	Cape Ann granite	4.10	6.08	49.8	37,800	122,950	2,469	Do.

TRANSMISSION OF HEAT.

Diagrams Nos. 1 and 2 show the results obtained with a number of specimens of stones, in which observations were made on the rise or fall in temperature, as indicated by thermometers inserted in pockets in the stones under conditions as described.

The stones experimented with were 4″ by 6″ by 12″ in dimensions, except sandstone block A, which was 10″.5 by 14″.75 by 16″.

Pockets three-eighths inch diameter, 4″ deep, were drilled in the middle of the ends of the stones.

In block A pocket No. 5 was at the middle of the stone and was 6″ deep; the center of pocket No. 4 was 4″ from one face, and drilled 6″ deep; pocket No. 1 was 1″ from a side of the stone, and this was 4″ deep.

The stones referred to on diagrum No. 1 were placed out of doors winter nights; they were brought into the testing room in the morning, placed on a wooden table, and observations began at 8 o'clock.

The temperature of the testing room the morning on which block A was brought in was 65° F. At the end of 1 hour 31 minutes the temperature of the room was 68° F.; at 2 hours 46 minutes, 69° F., and at 3 hours 20 minutes the temperature was 70° F., where it remained during the balance of the test.

The initial temperature of the pockets in block A varied as the diagram shows, which is explained by the fact that the temperature of the stone was rising at the time observations began, the temperature of the morning air having moderated over the minimum temperature of the night before.

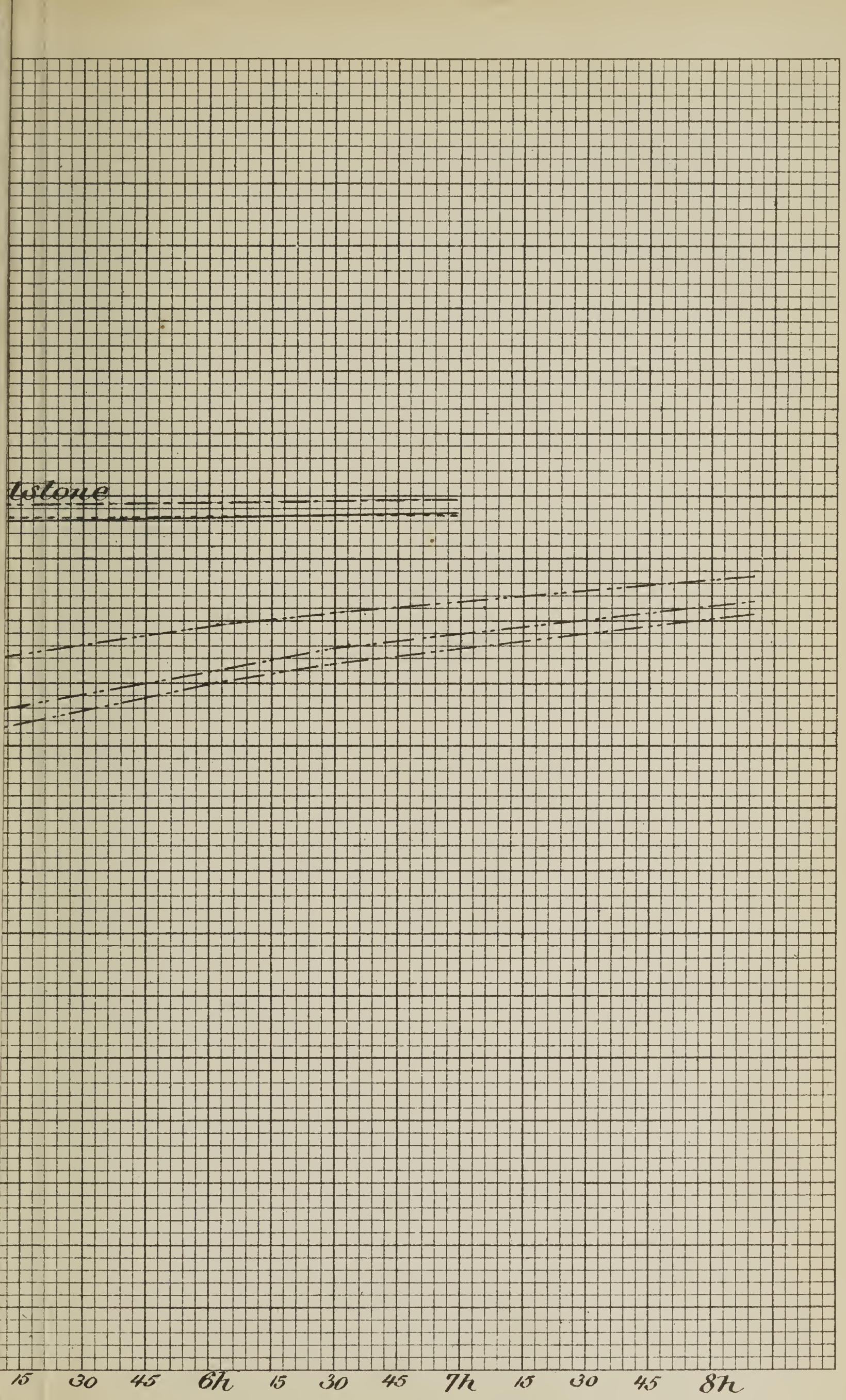
The other three stones during the time observations were made were exposed to a temperature of 70° to 70½° F.

The stones referred to on diagram No. 2 were 4″ by 6″ by 12″ in dimensions, and had pockets three-eighths inch diameter by 4″ deep drilled in one end of each.

Observations began when the stones were immersed to a depth of 6″ in an ice water bath at the temperature of 34° F.

The upper half of the stones, containing the pockets, were exposed to the temperature of the testing room. The temperature of the room for the several stones was as follows: for the Worcester granite, 74° F.; for the North River bluestone and the Portland (Conn.) red sandstone, 70° F.; for the Vermont marble the temperature of the room began at 65° and gradually rose in three-quarters of an hour to 75° F., where it remained for the balance of the test.

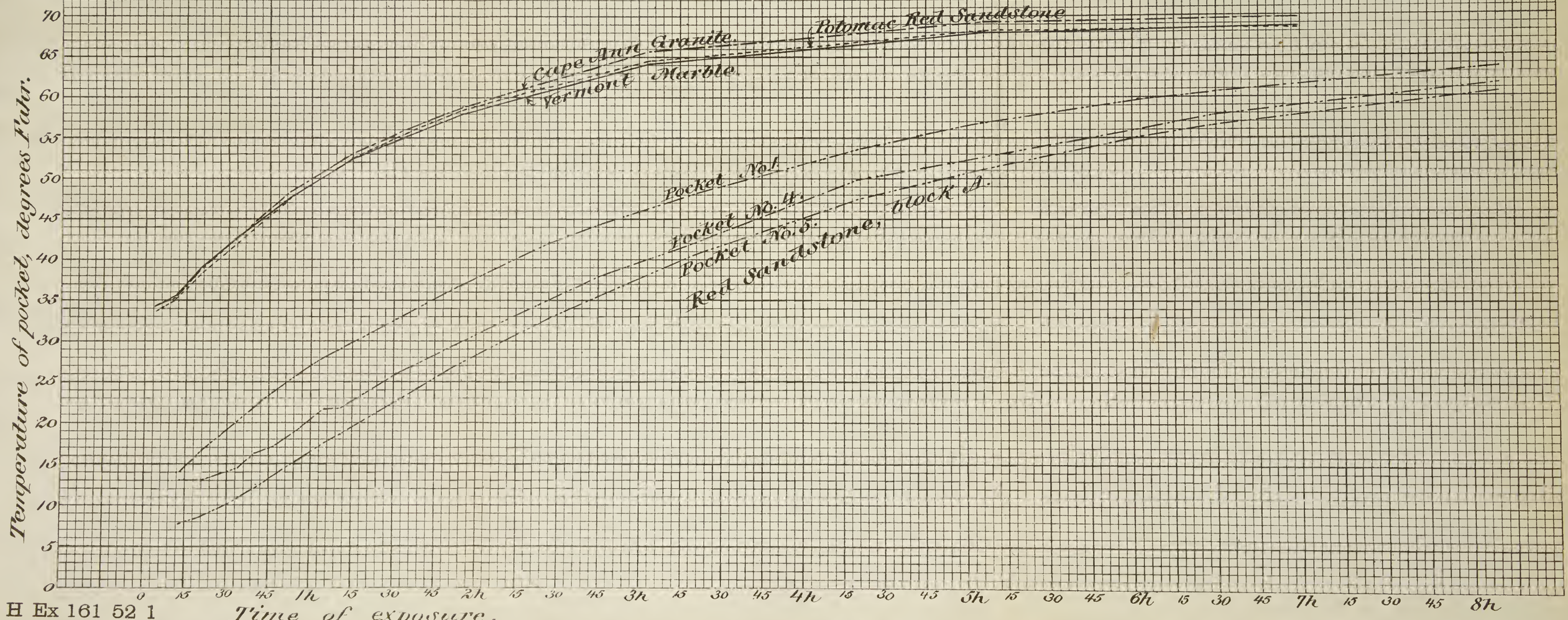
The sandstone showed a wet surface 2 inches above the water line. Subsequent observations were made on the bluestone, showing the rise of temperature after removal from the ice-water bath.


lstone
15
30
45
6h
15
30
45
7h
15
30
45
8h

No. 1.

Diagram showing rise in temperature of stones when exposed in air at temperature of 70+ Fahr.

(See descriptive text.)



H Ex 161 52 1

at Frost ice-water bath.

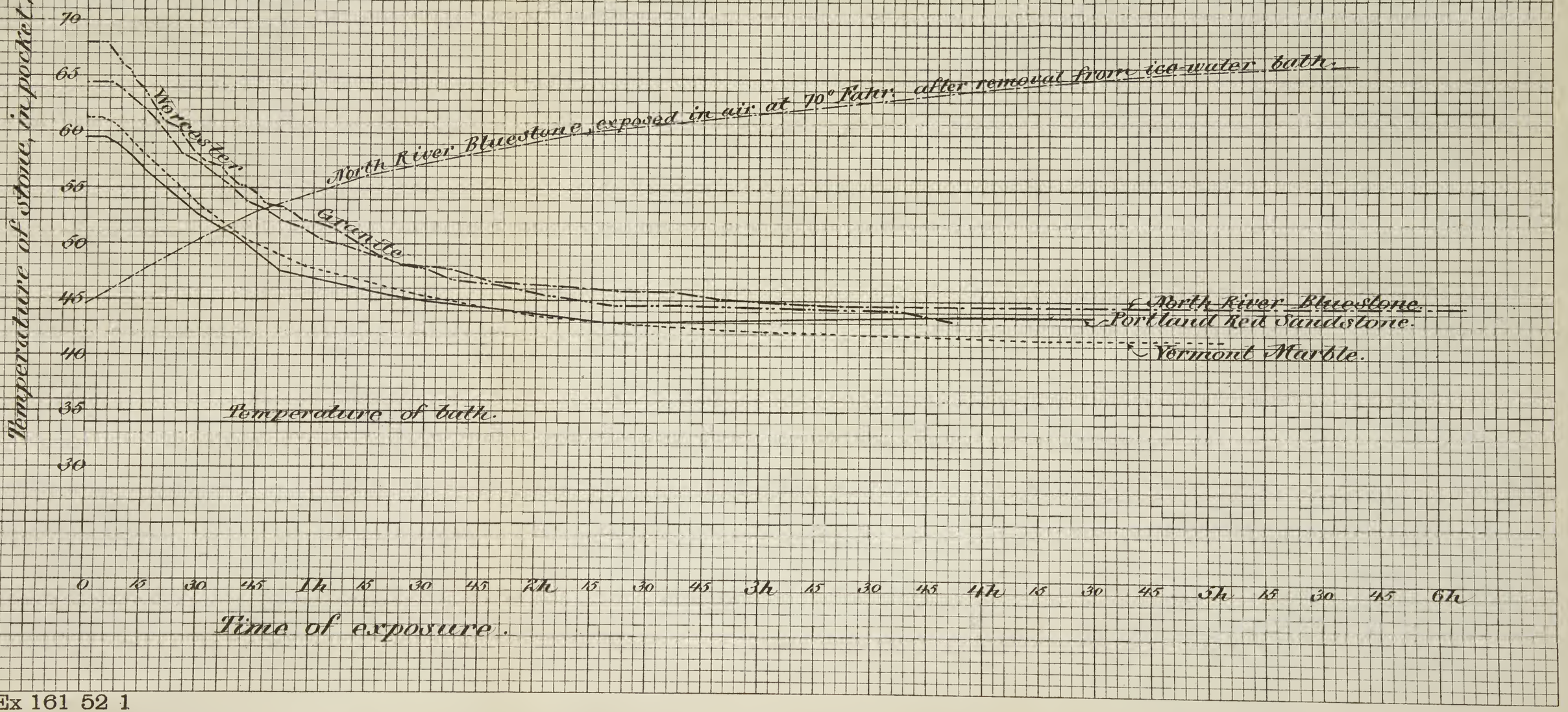
North River Bluestone.
Portland Red Sandstone.
Vermont Marble.

30 45 5h 15 30 45 6h

No. 2.

Diagram showing fall in temperature of stones when partly immersed in ice-water bath.

(See descriptive text.)



H Ex 161 52 1

BRICK PIERS.

Compression tests of piers laid in cement mortar, composed of 1 part cement, 2 parts sand.

These piers were built September, 1886, and were a part of the series of tests reported in 1886.

Age of piers when tested 6 years, 6 months.

Tests of individual bricks of which these piers were built, reported in 1885.

These piers were adjusted in the testing machine without the aid of end plates and side rods, hence no initial compression preceded the tests.

No. 5200.

12-Inch Brick Pier.

Built of 11 courses of common bricks.
Total weight, 260 pounds.
Weight per cubic foot 123.7 pounds.
Total height, 28″.20.
Sectional area, 11″.30 × 11″.40 = 128.8 square inches.
Average thickness of joints, $\frac{1}{4}$″.
Gauged length 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
6,440	50	0.	0.	Initial load.
12,880	100	.0007	.....	
19,320	150	.0012	.....	
25,760	200	.0019	.....	
32,200	250	.0024	.....	
38,640	300	.0029	.....	
45,080	350	.0037	.....	
51,520	400	.0047	.....	
57,960	450	.0057	.....	
64,400	500	.0067	.0017	
70,840	550	.0078	.....	
77,280	600	.0090	.....	
83,720	650	.0105	.....	
90,160	700	.0121	.....	
96,600	750	.0137	.....	
103,040	800	.0145	.0053	
109,480	850	.0181	.....	
115,920	900	.0197	.....	
122,360	950	.0217	.....	
128,800	1,000	.0237	.0097	
135,240	1,050	.0269	.....	
141,680	1,100	.0292	.....	
148,120	1,150	.0319	.....	
154,560	1,200	.0350	.....	
161,000	1,250	.0376	.....	
167,440	1,300	.0399	.0202	
173,880	1,350	.0457	.....	Crack in third course.
180,320	1,400	.0475	.....	
186,760	1,450	.0500	.....	
193,200	1,500	.0551	.....	Cracks generally present.
199,640	1,550	.0588	.....	
206,080	1,600	.0650	.....	
212,520	1,650	.0737	.....	
218,960	1,700	.0817	.....	
225,400	1,750	.0890	.....	
231,840	1,800	.0955	.....	
269,300	2,090	.....	.....	Ultimate strength.

No. 5201.

12-INCH BRICK PIER.

Built of 14 courses of common bricks.
Total weight, 333 pounds.
Weight per cubic foot, 124.7 pounds.
Total height, 35″.5.
Sectional area, 11″.4×11″.4=130 square inches.
Average thickness of joints, $\frac{1}{4}$″.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
6,500	50	0.	0.	Initial loads.
13,000	100	.0005	.....	
19,500	150	.0010	.....	
26,000	200	.0015	.....	
32,500	250	.0020	.....	
39,000	300	.0025	.....	
45,500	350	.0032	.....	
52,000	400	.0039	.....	
58,500	450	.0046	.....	
65,000	500	.0054	.0008	
71,500	550	.0063	.....	
78,000	600	.0072	.....	
84,500	650	.0081	.....	
91,000	700	.0091	.....	
97,500	750	.0103	.....	
104,000	800	.0117	.0025	
110,500	850	.0132	.....	
117,000	900	.0145	.....	Snapping sounds.
123,500	950	.0160	.....	
130,000	1,000	.0180	.0053	
136,500	1,050	.0202	.....	
143,000	1,100	.0215	.....	
149,500	1,150	.0234	.....	
156,000	1,200	.0251	.....	Cracks in 3 courses.
162,500	1,250	.0275	.....	
169,000	1,300	.0312	.0130	
175,500	1,350	.0348	.....	
182,000	1,400	.0368	.....	
188,500	1,450	.0410	.....	
195,000	1,500	.0445	.....	
201,500	1,550	.0475	.....	
208,000	1,600	.0525	.....	
214,500	1,650	.0573	.....	
221,000	1,700	.0640	.....	
227,500	1,750	.0665	.....	
234,000	1,800	.0690	.....	
238,000	1,830	.....	.....	Ultimate strength.

No. 5202.

12-INCH BRICK PIER (hollow.)

Built of 14 courses of common bricks.
Total weight, 229 pounds.
Weight per cubic foot, 128.5 pounds.
Total height, 28″.55.

	Square inches.
Dimensions, outside, 11.″40×11″.40	=130.0
Dimensions, core, 4″.70×4″.70	= 22.1
Sectional area	107.9

Average thickness of joints, $\frac{1}{4}$″.
This pier was soaked with water a period of 16 hours, during which time it absorbed 23 pounds of water. The test then followed.
First crack appeared at 101,000 pounds load.
Ultimate strength 206,200 pounds = 1,911 pounds per square inch,

No. 5203.

12-Inch Brick Pier (hollow).

Built of 20 courses of common bricks.
Total weight, 422 pounds.
Weight per cubic foot, 133.6 pounds.
Total height, 51″.20.

	Square inches.
Dimensions, outside, 11″.4×11″.50	=131.1
Dimensions, core, 5.″0×4″.90	= 24.5
	106.6

Average thickness of joints, $\frac{5}{16}$″.
Gauged length, 30″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
5,330	50	0.	0.	Initial load.
10,660	100	.0007	.....	
15,990	150	.0016	.....	
21,320	200	.0026	.....	
26,650	250	.0035	.....	
31,980	300	.0047	.....	
37,310	350	.0058	.....	
42,640	400	.0070	.....	
47,970	450	.0085	.....	
53,300	500	.0100	.0014	
58,630	550	.0120	.....	
63,960	600	.0137	.....	
69,290	650	.0157	.....	
74,620	700	.0180	.....	
79,950	750	.0200	.....	
85,280	800	.0228	.0060	
90,610	850	.0260	.....	
95,940	900	.0283	.....	
101,270	950	.0312	.....	
106,600	1,000	.0343	.0116	
111,930	1,050	.0385	.....	
117,260	1,100	.0412	.....	
122,590	1,150	.0448	.....	
127,920	1,200	.0474	.....	
133,250	1,250	.0517	.....	
138,580	1,300	.0556	.0237	
143,910	1,350	.0614	.....	
149,240	1,400	.0643	.....	
154,570	1,450	.0685	.....	
159,900	1,500	.0720	.....	
165,230	1,550	.0765	.....	Cracks in third course.
170,560	1,600	.0805	.....	
175,890	1,650	.0860	.....	
181,220	1,700	.0915	.....	
186,550	1,750	.0951	.....	
191,880	1,800	.1000	.....	
197,210	1,850	.1057	.....	
202,540	1,900	.1117	.....	
207,870	1,950	.1179	.....	
213,200	2,000	.1250	.....	
228,100	2,140	.....	.....	Ultimate strength.

No. 5204.

16-INCH BRICK PIER (hollow).

Built of 19 courses of face bricks.
Total weight, 617 pounds.
Weight per cubic foot, 138.7 pounds.
Total height, 45″.25.

	Square inches.
Dimensions, outside, 15″.4×15″.4	=237.1
Dimensions, core, 8.2×8.2	= 67.2
	169.9

Average thickness of joints, $\frac{3}{16}$″.
Gauged length, 30″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,495	50	0.	0.	Initial load.
16,990	100	.0008	.....	
25,485	150	.0018	.....	
33,980	200	.0029	.....	
42,475	250	.0040	.....	
50,970	300	.0051	.....	
59,465	350	.0063	.....	
67,960	400	.0076	.....	
76,445	450	.0091	.....	
84,950	500	.0106	.0014	
93,445	550	.0124	.....	
101,940	600	.0139	.....	
110,435	650	.0159	.....	
118,930	700	.0179	.....	
127,425	750	.0200	.....	
135,920	800	.0223	.0049	
144,415	850	.0248	.....	
152,910	900	.0275	.....	
161,405	950	.0305	.....	
169,900	1,000	.0328	.0090	
178,395	1,050	.0366	.....	
186,890	1,100	.0394	.....	
195,385	1,150	.0423	.....	
203,880	1,200	.0445	.....	
212,375	1,250	.0483	.....	
220,870	1,300	.0521	.....	
229,365	1,350	.0583	.....	
237,860	1,400	.0618	.....	
246,355	1,450	.0658	.....	Cracks in 4 courses.
254,850	1,500	.0695	.....	
263,345	1,550	.0738	.....	
271,840	1,600	.0789	.....	
280,335	1,650	.0839	.....	
288,830	1,700	.0891	.....	
297,325	1,750	.0948	.....	
305,820	1,800	.1040	.....	
314,315	1,850	.1158	.....	
320,100	1,884	.....	.....	Ultimate strength.

TABULATION OF CRUSHING STRENGTH OF BRICK PIERS.

No. of test.	Nominal cross-section dimensions.		Kind of bricks.	Composition of mortar.	Weight per cubic foot.	Actual dimensions.				Sectional area.	Ultimate strength.			Remarks.
						Height.		Cross-section dimensions.			Total.	Per square inch.	Per square foot.	
	Inches.	*Inches.*			*Pounds.*	*Feet.*	*Inches.*	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Tons.*	
5200	12	12	Common	Cement 1, sand 2	123.7	2	4.20	11.30	11.40	128.8	269,300	2,090	150.5	
5201	12	12	do	do	124.7	2	11.50	11.4	11.4	130.	238,000	1,830	131.8	
5202*	12	12	do	do	128.5	2	4.55	11.4 4.7	11.4 4.7	107.9	206,200	1,911	137.6	Hollow.
5203	12	12	do	do	133.6	4	3.20	11.4 5.0	11.5 4.9	106.6	228,100	2,140	154.1	Do.
5204	16	16	Face	do	138.7	3	9.25	15.4 8.2	15.4 8.2	169.9	320,100	1,884	135.6	Do.

* Soaked with water sixteen hours.

5-9855

1971 - 6½ grs

ADHESION OF NAILS IN WOOD.

These nails were driven June 27, 1884, into blocks of wood which were in a water-soaked condition at that time.
Since driving the nails the blocks of wood have been stored in a cool, dry building.
Interval of time in which the nails were in the wood, six years, nine and a half months.
Size of nails, 60*d*.

WHITE PINE STICK.

No. of test.	Mean dimensions of nails.	Length driven.	Surface in wood.	Adhesion resistance. Maximum. Total.	Maximum. Per square inch.	When drawn, inches. ⅛.	¼.	⅜.	½.	¾.	1.	1¼.	1½.	1¾.	2.	2¼.	2½.	2¾.	3-	Remarks.
	Inch.	*Inches.*	*Sq.inch.*	*Pounds*	*Pounds*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
5216	.242 x .270	4	4.10	811	198	.....	448	.....	310	232	198	169	138	.....	.....	.....	.....	.....	.....	Driven 6 years 9½ months.
5217	.241 x .270	3.98	4.07	916	225	608	430	336	276	230	190	149	132	110	102	.....	.....	.....	.....	Do.
5218	.245 x .260	4	4.04	560	138	404	348	.....	278	221	181	153	119	107	102	.....	.....	.....	.....	Do.
5219	.242 x .270	4	4.10	900	220	642	496	422	376	302	268	222	202	181	152	.....	.....	.....	.....	Do.
5220	.242 x .270	4	4.10	1,172	286	905	762	670	589	498	422	352	290	246	208	156	116	81	43	No. 5219 redriven 1 hour before testing.
5221	.240 x .270	4	4.10	1,178	287	818	654	577	480	400	310	285	250	208	192	.....	.....	.....	.....	No. 5219 redriven immediately before testing.

YELLOW PINE STICK.

5222	.240 x .280	4.	4.16	1,270	305	1,108	830	682	575	446	312	232	122	92	70	.....	.....	.....	.....	Driven 6 years 9½ months.
5223	.240 x .265	3.96	4	1,100	275	905	735	614	555	454	396	366	280	221	194	.....	.....	.....	.....	Do.
5224	.235 x .250	3.96	3.84	1,280	333	1,106	927	830	770	718	636	542	460	365	294	.....	.....	.....	.....	Do.
5225	.240 x .270	3.97	4.05	1,080	267	900	720	580	500	400	328	2.6	290	260	225	.....	.....	.....	.....	Do.
5226	.240 x .270	3.97	4.05	3,062	756	2,200	1,748	1,500	1,327	1,049	904	747	611	510	377	300	205	.....	.....	Nail No. 5225, redriven immediately before testing.
5227	250 x .270	3.97	4.05	3,105	767	2,715	2.010	1,598	1,250	730	400	200	64	2	.....	.....	.....	.....	.....	Nail No. 5225. redriven immediately before testing.
5228	.235 x .250	3.95	3.83	2,180	569	1,517	1,200	1,016	888	702	606	490	405	308	240	.....	.....	.....	.....	Nail No. 5234, driven 16 hours before testing.
5229	.240 x .265	4	4.04	2,346	581	1,520	1,255	1,040	918	729	612	532	410	386	332	.....	.....	.....	.....	Nail No. 5223, driven 17 hours before testing.
5230	.240 x .265	4	4.04	2,643	654	1,806	1,398	1,240	1,094	918	762	660	598	505	396	.....	.....	.....	.....	Nail No. 5223, driven immediately before testing.

WHITE OAK STICK.

5231	.240 x .220	2.12	1.95	1,790	917	800	544	400	284	180	56	.....	.....	.....	.....	.....	.....	.....	.....	Driven 6 years 9½ months.
5232	.240 x .230	2.37	2.23	1,971	883	862	548	368	298	171	100	.....	.....	.....	.....	.....	.....	.....	.....	Do.
5233	.240 x .230	2.20	2.07	2,045	987	1,048	637	382	284	200	120	.....	.....	.....	.....	.....	.....	.....	.....	Do.
5234	.240 x .230	2.02	1.90	2,206	1,161	1,546	1,205	956	810	565	416	258	136	.....	.....	.....	.....	.....	.....	Nail No. 5233, redriven immediately before testing.

CORDAGE.

HEMP AND MANILA ROPE

FROM

THE PLYMOUTH CORDAGE COMPANY,

ALSO

HEMP, MANILA, AND WIRE ROPE

FROM THE

BOSTON NAVY-YARD.

747

TARRED HEMP ROPE.

Specimens from coil No. 1, having the following dimensions and description:

Three-stranded rope, seven yarns per strand.

Lay, one turn in 1″.3.

Circumference, 1″.8.

Weight per fathom, 10.4 ounces.

Strands, when unlayed, are 28.1 per cent longer than the rope, and the yarns 39.9 per cent longer than the rope.

No. 4696.

FIRST SPECIMEN FROM COIL NO. 1.

Ends secured to cleats with regular belaying-pin hitches.
Gauged length, 6 feet.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
100	1.65	1.65	.....	
200	2.70	1.05	.....	
400	4.15	1.45	.....	
600	5.15	1.00	.....	
800	6.00	.85	.....	
1,000	6.72	.72	.....	
1,200	7.10	.38	.....	
1,400	7.65	.55	.....	
1,500	8.20	.55	6.20	
				Interval of rest.
100	5.80	—.40	.....	
200	6.10	+.30	.....	
400	6.58	.48	.....	
600	7.07	.49	.....	
800	7.37	.30	.....	
1,000	7.70	.33	.....	
1,200	8.10	.40	.....	
1,400	8.30	.20	.....	
1,500	8.47	.17	.....	
1,600	8.70	.23	.....	
1,800	8.90	.20	.....	
2,000	9.33	.43	.....	
2,200	9.70	.37	.....	Tensile strength.

Parted 2 strands 18″ from the cleat.

No. 4697.

SECOND SPECIMEN FROM HEMP COIL NO. 1.

Secured to cleats in same manner as first specimen.
Gauged length, 6 feet.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
100	1.10	1.10	.....	
200	2.15	1.05	.....	
400	3.90	1.75	.....	
600	5.23	1.33	.....	
800	6.37	1.14	.....	
1,000	7.20	.83	.....	
1,200	7.85	.65	.....	
1,400	8.45	.60	.....	
1,500	8.85	.45	6.10	
.....	.....	.....	5.70	After resting 15 hours.
100	5.70	0.	.....	
200	6.00	.30	.....	
400	6.58	.58	.....	
600	7.07	.49	.....	
800	7.55	.48	.....	
1,000	7.98	.43	.....	
1,000	8.23	.25	.....	After 5 minutes.
1,000	8.35	.12	.....	After 10 minutes.
1,000	8.38	.03	.....	After 15 minutes. Began to wet rope with warm water, 110° F.
1,000	8.58	.20	.....	After 20 minutes, or 5 minutes after wetting began.
1,000	8.70	.12	.....	After 25 minutes, or 10 minutes after wetting began.
1,000	8.86	.16	.....	After 30 minutes, or 15 minutes after wetting began.
0	.....	.....	7.00	
1,000	8.86	.....	.....	
1,200	9.12	.26	.....	
1,400	9.40	.28	.....	
1,600	9.82	.42	.....	
1,800	10.25	.43	.....	
1,940	10.50	.25	.....	Tensile strength.

Parted 2 strands at middle of the length.

No. 4698.

THIRD SPECIMEN FROM HEMP COIL NO. 1.

Secured to cleats in same manner as first specimen.

Gauged length of 6 feet laid off, then rope wet with warm water, applied with sponges. At the expiration of 10 minutes the gauged length measured 6″.10.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
0	.10	.....	.....	Wetting discontinued.
100	1.48	1.38	.....	
200	2.57	1.09	.....	
400	4.53	1.96	.....	
600	5.90	1.37	.....	
800	7.00	1.10	.....	
1,000	7.83	.83	.....	
1,000	8.50	.67	.....	After 5 minutes.
800	8.43	— .07	.....	
800	8.40	— .03	.....	Do.
600	8.28	— .12	.....	
600	8.20	— .08	.....	Do.
400	8.06	— .14	.....	
400	8.00	— .06	.....	Do.
200	7.77	— .23	.....	
200	7.54	— .23	.....	Do.
0	.....	.....	6.97	
0	.....	.....	6.70	Do.
200	7.04	— .50	.....	
200	7.07	+ .03	.....	Do.
400	7.40	.33	.....	
400	7.52	.12	.....	Do.
600	7.78	.26	.....	
600	7.91	.13	.....	Do.
800	8.12	.21	.....	
800	8.36	.24	.....	Do.
1,000	8.62	.26	.....	
1,000	8.77	.15	.....	Do.
1,000	.....	.....	.....	Load left on rope.
600	8.63	— .14	.....	Load at end of 1½ hours.
1,000	8.94	+ .31	.....	
0	.....	.....	7.00	
1,000	8.94	0.	.....	
1,200	9.30	.36	.....	
1,400	9.68	.38	.....	
1,600	10.05	.37	.....	
1,800	10.52	.47	.....	
2,000	10.90	.38	.....	
2,200	11.17	.27	.....	
2,230	.....	.....	.....	Tensile strength.

Square break at cleat.

No. 4699.

FOURTH SPECIMEN FROM HEMP COIL NO. 1.

Secured to cleats in same manner as the first specimen.

Gauged length of 6 feet laid off, and rope then soaked in cold water (50° F.) 2 hours, at expiration of which time the gauged length of 6 feet had increased ″.57.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
0	.57	.....	.....	
100	2.62	2.05	.....	
200	3.76	1.14	.....	
400	5.15	1.39	.....	
600	6.10	.95	.....	
800	6.98	.88	.....	
1,000	7.60	.62	5.20	
1,000	7.88	.28	.....	
1,200	8.37	.49	.....	
1,400	8.70	.33	.....	
1,500	9.02	.32	6.45	
1,500	9.30	.28	.....	
1,600	9.54	.24	.....	
1,800	9.85	.31	.....	
2,200	10.25	.40	.....	
2,300	10.58	.33	7.75	Tensile strength.

After the rope had been loaded with 2,300 pounds, the load was released, the set determined, and load reapplied. Upon this reapplication the rope parted two strands at the cleat when the load reached 2,250 pounds.

No. 4787.

SAMPLE FROM HEMP COIL NO. 1.

An eye-splice at each end, and a short splice at middle of length.
Tested wet after soaking in water 7½ days.
Specimen from rope previously tested.
Tensile strength, 1,960 pounds.
Parted 2 strands at the short splice.

TARRED HEMP ROPE.

Specimen from coil No. 2, having the following dimensions and description:

Three-stranded rope, twenty-two yarns per strand.

Lay, one turn in 2″.7.

Circumference, 3″.2.

Weight, 1 pound 15¾ ounces per fathom.

Strands, when unlayed, are 25.6 per cent longer than the rope, and the yarns 42.6 per cent longer than the rope.

No. 4717.

SAMPLE FROM HEMP COIL NO. 2.

Ends secured to cleats with regular belaying-pin hitches.

Tensile strength, 6,560 pounds.

Parted at the cleat.

No. 4718.

SAMPLE FROM HEMP COIL NO. 2.

Two pieces of rope tied together with a square knot, which was wet with hot water; other ends secured to cleats.

Tensile strength, 4,850 pounds.

Parted one strand at the square knot.

Three pulls were given this sample.

During the first pull the wet knot slowly unrolled under 2,400 pounds, the stress not exceeding this amount when the stroke of the testing-machine piston was exhausted.

Taking a new stroke of the piston the knot held until 3,800 pounds was reached, when it again began to slowly unroll, and continued with slight fluctuations of load to the end of the stroke.

The rope parted at the third stroke of the piston. No unrolling occurred during this pull.

As the knot unrolled, rope in a less wet state was reached than at first under the knot.

No. 4719.

SAMPLE FROM HEMP COIL NO. 2.

Two pieces of rope that had been soaked in hot water tied together with a square knot while wet, other ends secured to cleats.

Tensile strength, 3,340 pounds.

Parted at the knot.

Three pulls were given the knot, the maximum resistance of each being 900 pounds, 2,500 pounds, and 3,340 pounds, respectively.

During the first and second pulls the knot slowly unrolled, and during the third pull the knot unrolled for a time, then the rope parted.

No. 4745.

SAMPLE FROM HEMP COIL NO. 2.

Rope secured by eyes spliced in ends.

Gauged length, 6 feet.

Applied Loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
1,000	5.13	5.13	.....	
2,000	6.82	1.69	.....	
3,000	8.07	1.25	.....	
4,000	8.86	.79	.....	
5,000	9.68	.82	.....	
6,000	10.33	.65	.....	
6,320	.....	.....	.....	Tensile strength.

Parted 2 strands at the eye-splice.

No. 4752.

SAMPLE FROM HEMP COIL NO. 2.

Secured with a round turn and two half hitches at each end.

Tensile strength, 7,780 pounds.

Parted 1 strand at the half hitches.

No. 4753.

SAMPLE FROM HEMP COIL NO. 2.

Secured with a round turn and two half hitches at each end.

Tensile strength, 7,150 pounds.

Parted 1 strand between half hitches and the cleat.

No. 4786.

SAMPLE FROM HEMP COIL NO. 2.

Prepared with eye splices in ends.

A gauged length of 4 feet established on part between the eyes; then sample was put in water, where it soaked $2\frac{1}{2}$ days; then taken out of water and tested while wet.

Contraction in gauged length, 2″.3.

Present circumference, $3\frac{3}{16}$″.

This sample was taken from a piece which had been strained in a former test, but showed no broken yarns.

Tensile strength, 6,050 pounds.

Parted 2 strands at the eye-splice.

TARRED HEMP ROPE.

Specimens from coil No. 3, having the following dimensions and description:

Three-stranded rope, fifty yarns per strand.

Lay, one turn in $3\frac{3}{4}''$.

Circumference, $4\frac{7}{8}''$.

Weight, 4 pounds 9 ounces per fathom.

Strands, when unlayed, are 26.5 per cent longer than the rope, and the yarns 39.6 per cent longer than the rope.

No. 4721.

SAMPLE FROM HEMP COIL NO. 3.

Ends secured to cleats with regular belaying-pin hitches.

Tensile strength, 13,980 pounds.

Parted 2 strands at the cleat.

No. 4743.

SAMPLE FROM HEMP COIL NO. 3.

Secured by eyes spliced in ends.
Gauged length, 6 feet.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
1,000	3.68	3.68	.....	
2,000	4.75	1.07	.....	
3,000	5.60	.85	.....	
4,000	6.43	.83	.....	
5,000	7.03	.60	.....	
6,000	7.40	.37	.....	Immediate elongation.
	8.00	.60	.....	After five minutes.
5,000	7.92	—.08	.....	
4,000	7.87	—.05	.....	
3,000	7.75	—.12	.....	
2,000	7.65	—.10	.....	
1,000	7.28	—.37	6.60	Immediate set.
			6.00	Set after five minutes.
1,000	6.44	—.84	.....	
2,000	6.88	+.44	.....	
3,000	7.24	.36	.....	
4,000	7.54	.30	.....	
5,000	7.78	.24	.....	
6,000	8.04	.26	.....	
7,000	8.37	.33	.....	
8,000	8.58	.21	.....	
9,000	8.87	.29	.....	
10,000	9.18	.31	.....	
11,000	9.50	.32	.....	
12,000	9.67	.17	.....	Immediate elongation.
	9.95	.28	.....	After five minutes.
11,000	9.90	—.05	.....	
10,000	9.84	—.06	.....	
9,000	9.80	—.04	.....	
8,000	9.76	—.04	.....	
7,000	9.69	—.07	.....	
6,000	9.64	—.05	.....	
5,000	9.54	—.10	.....	
4,000	9.44	—.10	.....	
3,000	9.26	—.18	.....	
2,000	9.12	—.14	.....	
1,000	8.88	—.24	7.98	Immediate set.
			7.70	Set after five minutes.
1,000	7.98	—.90	.....	
2,000	8.35	+.37	.....	
3,000	8.61	.26	.....	
4,000	8.81	.20	.....	
5,000	8.99	.18	.....	
6,000	9.17	.18	.....	
7,000	9.31	.14	.....	
8,000	9.50	.19	.....	
9,000	9.63	.13	.....	
10,000	9.68	.05	.....	
11,000	9.80	.12	.....	
12,000	9.95	.15	.....	
13,000	10.14	.19	.....	
14,000	10.28	.14	.....	
15,000	10.43	.15	.....	
16,000	10.58	.15	.....	
16,900	.....	.....	.....	Tensile strength.

Parted 1 strand at the eye splice.

No. 4750.

SAMPLE FROM HEMP COIL NO. 3.

One end secured by bowline knot; other end secured to cleat with belaying-pin hitches.
Tensile strength, 9,180 pounds.
Parted 1 strand at the knot.
This sample was warm and pliable when tested.

No. 4751.

SAMPLE FROM HEMP COIL NO. 3.

One end secured with a round turn and two half hitches; other secured to cleat with belaying-pin hitches.
Tensile strength, 14,500 pounds.
Parted 2 strands at the cleat.

TARRED HEMP ROPE.

Specimens from coil No. 4, having the following dimensions and description:

Three-stranded rope, ninety-eight yarns per strand.
Lay, one turn in $4\frac{1}{2}''$.
Circumference, $6\frac{1}{2}''$.
Weight per fathom, 9 pounds 6 ounces.
Strands, when unlayed, are 31.2 per cent longer than the rope, and the yarns 42.8 per cent longer than the rope.

No. 4727.

SAMPLE FROM HEMP COIL NO. 4.

Ends secured to cleats with regular belaying-pin hitches.
Tensile strength, 21,680 pounds.
Parted 1 strand at the cleat.

No. 4724.

SAMPLE FROM HEMP COIL NO. 4.

Ends secured to cleats with belaying-pin hitches.
Gauged length, 6 feet.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
1,000	3.07	3.07	.....	
2,000	3.97	.90	.....	
3,000	5.08	1.11	.....	
4,000	5.83	.75	.....	
5,000	6.40	.57	.....	
6,000	7.07	.67	.....	
7,000	7.33	.26	.....	
8,000	7.68	.35	.....	
9,000	7.96	.28	.....	
2,000	7.34	− .62	.....	Immediate elongation.
	7.25	− .09	.....	After 2 minutes.
0	.....	.....	.....	Load entirely removed.
2,000	6.18	−1.07	.....	
10,000	8.43	+2.25	.....	
11,000	8.82	.39	.....	
12,000	9.05	.23	.....	
13,000	9.37	.32	.....	
14,000	9.68	.31	.....	
15,000	9.87	.19	.....	
16,000	10.08	.21	.....	
17,000	10.31	.23	.....	
18,000	10.49	.18	.....	
19,000	10.68	.19	.....	
19,800	.....	.....	.....	Tensile strength.

Parted 1 strand at the cleat.

No. 4741.

SAMPLE FROM HEMP COIL NO. 4.

Rope secured to cleats with eye splices in ends.
Gauged length, 6 feet.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
1,000	2.20	2.20	.....	
2,000	3.40	1.20	.....	
3,000	4.40	1.00	.....	
4,000	4.90	.50	.....	
5,000	5.45	.55	.....	
6,000	5.90	.45	.....	
7,000	6.25	.35	.....	
8,000	6.60	.35	.....	
9,000	6.90	.30	.....	
10,000	7.20	.30	.....	Immediate elongation.
	7.64	.44	.....	After 5 minutes.
	7.80	.16	.....	After 10 minutes.
	7.90	.10	.....	After 15 minutes.
8,000	7.84	— .06	.....	
6,000	7.78	— .06	.....	
4,000	7.47	— .31	.....	
	7.33	— .14	.....	After 5 minutes.
2,000	7.14	— .19	.....	
1,000	6.97	— .17	6.17	Immediate set.
			5.51	Set after 5 minutes.
1,000	5.69	—1.28	.....	
2,000	6.06	+ .37	.....	
4,000	6.64	.58	.....	
6,000	7.09	.45	.....	
8,000	7.34	.25	.....	
10,000	7.70	.36	.....	
11,000	7.93	.23	.....	
12,000	8.12	.19	.....	
13,000	8.26	.14	.....	
14,000	8.47	.21	.....	
15,000	8.62	.15	.....	
	8.83	.21	.....	After 5 minutes.
12.000	8.73	— .10	.....	
10,000	8.60	— .13	.....	
8,000	8.47	— .13	.....	
6,000	8.32	— .15	.....	
4,000	8.10	— .22	.....	
2,000	7.84	— .26	.....	
1,000	7.50	— .34	6.80	Immediate set.
			6.25	Set after 5 minutes.
1,000	6.40	—1.10	.....	
2,000	6.68	+ .28	.....	
4,000	7.30	.62	.....	
6,000	7.68	.38	.....	
8,000	7.97	.29	.....	
10,000	8.27	.30	.....	
12,000	8.49	.22	.....	
14,000	8.67	.18	.....	
15,000	8.79	.12	.....	
16,000	9.00	.21	.....	
17,000	9.20	.20	.....	
18,000	9.32	.12	.....	
19,000	9.48	.16	.....	
20,000	9.68	.20	.....	
	9.87	.19	.....	After 5 minutes.
18,000	9.82	— .05	.....	
16,000	9.72	— .10	.....	
14,000	9.62	— .10	.....	
12,000	9.52	— .10	.....	
10,000	9.43	— .09	.....	
8,000	9.22	— .21	.....	
6,000	9.03	— .19	.....	
4,000	8.83	— .20	.....	
2,000	8.54	— .29	.....	
1,000	8.33	— .21	7.63	Immediate set.
			7.10	Set after 5 minutes.
1,000	7.28	—1.05	.....	
2,000	7.53	+ .25	.....	
4,000	7.98	.45	.....	
6,000	8.30	.32	.....	

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	*Inch.*	
8,000	8.60	.30	.....	
10,000	8.80	.20	.....	
12,000	9.03	.23	.....	
14,000	9.27	.24	.....	
16,000	9.43	.16	.....	
18,000	9.70	.27	.....	
20,000	9.85	.15	.....	
21,000	10.00	.15	.....	
22,000	10.20	.20	.....	
23,000	.....	.....	.....	Tensile strength.

Parted 2 strands at the eye splice.

MANILA ROPE.

Specimens from coil No. 1, having the following dimensions and description:

Three-stranded rope, seven yarns per strand.
Lay, one turn in 1″.66.
Circumference, 1″.50.
Weight per fathom, 6.63 ounces.

No. 4740.

SAMPLE FROM MANILA COIL NO. 1.

Ends secured to cleats with belaying-pin hitches.
Tensile strength, 2,270 pounds.
Parted 2 strands at the cleat.

MANILA ROPE.

Specimens from coil No. 2, having the following dimensions and description:

Lay, one turn in $2\frac{3}{4}''$.
Circumference, $2\frac{7}{8}''$.
Weight per fathom, 1 pound 7 ounces.

No 4739.

SAMPLE FROM MANILA COIL NO. 2.

Ends secured to cleats with belaying-pin hitches.
Tensile strength, 6,250 pounds.
Parted 2 strands at the cleat.

No. 4746.

SAMPLE FROM MANILA COIL NO. 2.

Ends secured by eye-splices in the ends.
Gauged length, 6 feet.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
1,000	4.98	.....	.....	
2,000	6.77	1.79	.....	
3,000	8.30	1.53	.....	
4,000	9.60	1.30	.....	
5,000	10.77	1.17	.....	
6,000	11.60	.83	.....	
7,000	12.38	.78	.....	Tensile strength.

Parted 1 strand 3 feet from the eye-splice.

MANILA ROPE.

Specimens from coil No. 3, having the following dimensions and descriptions:

Three-stranded rope—thirty-nine yarns per strand.
Lay, one turn in 4″.
Circumference, $4\frac{11}{16}$″.
Weight per fathom, 3 pounds $4\frac{1}{2}$ ounces.

No. 4738.

SAMPLE FROM MANILA COIL NO. 3.

Ends secured to cleats with belaying pin hitches.
Tensile strength, 14,900 pounds.
Parted 1 strand at the cleat.

No. 4744.

SAMPLE FROM MANILA COIL NO. 3.

Ends secured to cleats by eye-splices in the ends.
Gauged length, 6 feet.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
1,000	3.98	3.98	.....	
2,000	4.85	.87	.....	
3,000	5.96	1.11	.....	
4,000	6.90	.94	.....	
5,000	7.65	.75	.....	
6,000	8.45	.80	.....	Immediate elongation.
	8.93	.48	.....	After 5 minutes.
5,000	8.87	— .06	.....	
4,000	8.78	— .09	.....	
3,000	8.68	— .10	.....	
2,000	8.48	— .20	.....	
1,000	8.03	— .45	5.70	Immediate set.
.....	.....	.....	5.20	Set after 5 minutes.
1,000	6.66	—1.37	.....	
2,000	7.28	+ .62	.....	
3,000	7.64	.36	.....	
4,000	8.05	.41	.....	
5,000	8.50	.45	.....	
6,000	8.78	.28	.....	
7,000	9.18	.40	.....	
8,000	9.60	.42	.....	
9,000	10.07	.47	.....	
10,000	10.58	.51	.....	
11,000	11.10	.52	.....	
12,000	11.54	.44	.....	Immediate elongation.
.....	11.91	.37	.....	After 5 minutes.
11,000	11.86	— .05	.....	
10,000	11.78	— .08	.....	
9,000	11.74	— .04	.....	
8,000	11.64	— .10	.....	
7,000	11.56	— .08	.....	
6,000	11.52	— .04	.....	
5,000	11.38	— .14	.....	
4,000	11.21	— .17	.....	
3,000	11.10	— .11	.....	
2,000	10.84	— .26	.....	
1,000	10.50	— .34	8.43	Immediate set.
.....	.....	.....	8.21	Set after 5 minutes.
1,000	9.20	—1.30	.....	
2,000	9.65	+ .45	.....	
3,000	9.98	.33	.....	

No. 4744—Continued.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	
4,000	10.26	.28	.....	
5,000	10.50	.24	.....	
6,000	10.74	.24	.....	
7,000	10.94	.20	.....	
8,000	11.14	.20	.....	
9,000	11.30	.16	.....	
10,000	11.51	.21	.....	
11,000	11.64	.13	.....	
12,000	11.88	.24	.....	
13,000	12.00	.12	.....	
14,000	12.20	.20	.....	
14,750	.....	.....	.....	Tensile strength.

Parted 1 strand at the eye-splice.

No. 4784.

SAMPLE FROM MANILA COIL NO. 3.

Prepared with eye-splices at each end, then soaked in water 24 hours before testing. Tested while wet.

Tensile strength, 17,280 pounds.

Parted 1 strand at the eye-splice.

No. 4757.

SAMPLE FROM MANILA COIL NO. 3.

Soaked in water and tested wet.

Ends secured with a round turn and two half-hitches.

Tensile strength, 21,800 pounds.

Parted 1 strand at the two half-hitches.

This sample drew along the hitch considerably before fracture, and was chafed in vicinity of the place where it ruptured.

MANILA ROPE.

Specimens from coil No. 4, having the following dimensions and description:

Three-stranded rope—77 yarns per strand.
Lay, one turn in $5\frac{1}{2}''$.
Circumference, $6\frac{1}{2}''$.
Weight per fathom, 6 pounds 9.4 ounces.

No. 4737.

SAMPLE FROM MANILA COIL NO. 4.

Ends secured to cleats with belaying-pin hitches.
Tensile strength, 25,560 pounds.
Parted 1 strand at the cleat.

No. 4742.

SAMPLE FROM MANILA COIL NO. 4.

Ends secured to cleats by eye-splices in the ends.
Gauged length, 6 feet.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
1,000	3.53	3.53	.....	
2,000	4.40	.87	.....	
3,000	5.02	.62	.....	
4,000	5.57	.55	.....	
5,000	6.07	.50	.....	
6,000	6.50	.43	.....	
7,000	6.91	.41	.....	
8,000	7.32	.41	.....	
9,000	7.58	.26	.....	
10,000	8.03	.45	.....	Immediate elongation.
	8.30	.27	.....	After 5 minutes.
8,000	8.17	—.13	.....	
6,000	8.07	—.10	.....	
4,000	7.90	—.17	.....	
2,000	7.58	—.32	.....	
1,000	7.10	—.48	5.35	Immediate set.
.....	.....	.....	4.83	Set after 5 minutes.
1,000	5.82	—1.28	.....	
2,000	6.38	+.56	.....	
4,000	6.95	.57	.....	
6,000	7.47	.52	.....	
8,000	7.90	.43	.....	
10,000	8.30	.40	.....	
11,000	8.50	.20	.....	
12,000	8.80	.30	.....	
13,000	8.98	.18	.....	
14,000	9.30	.32	.....	
15,000	9.56	.26	.....	
14,000	9.50	—.06	.....	
12,000	9.43	—.07	.....	
10,000	9.38	—.05	.....	
8,000	9.26	—.12	.....	
6,000	9.08	—.18	.....	
4,000	8.80	—.28	.....	
2,000	8.40	—.40	.....	
1,000	8.05	—.35	6.45	Immediate set.
.....	.....	.....	6.35	Set after 5 minutes.
1,000	6.90	—1.15	.....	
2,000	7.35	+.45	.....	
4,000	7.88	.53	.....	
6,000	8.25	.37	.....	
8,000	8.58	.33	.....	
10,000	8.85	.27	.....	

No. 4742—Continued.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	
12,000	9.20	.35	.....	
14,000	9.50	.30	.....	
15,000	9.70	.20	.....	
16,000	9.80	.10	.....	
17,000	10.05	.25	.....	
18,000	10.28	.23	.....	
19,000	10.47	.19	.....	
20,000	10.70	.23	.....	
18,000	10.68	—.02	.....	
16,000	10.60	—.08	.....	
14,000	10.50	—.10	.....	
12,000	10.42	—.08	.....	
10,000	10.38	—.04	.....	
8,000	10.28	—.10	.....	
6,000	9.98	—.30	.....	
4,000	9.78	—.20	.....	
2,000	9.43	—.35	.....	
1,000	9.02	—.41	8.10	Immediate set.
.....	.....	.....	7.75	Set after 5 minutes.
1,000	8.05	—.97	.....	
2,000	8.38	+.33	.....	
4,000	8.85	.47	.....	
6,000	9.15	.30	.....	
8,000	9.45	.30	.....	
10,000	9.67	.22	.....	
12,000	9.88	.21	.....	
14,000	10.13	.25	.....	
16,000	10.40	.27	.....	
18,000	10.58	.18	.....	
20,000	10.70	.12	.....	
21,000	11.02	.32	.....	Load released to zero, and new stroke of the piston taken.
22,000	11.10	.08	.....	
23,000	11.32	.22	.....	
24,000	11.46	.14	.....	
25,000	11.70	.24	.....	
26,000	.....	.....	.....	Tensile strength.

Parted 1 strand at the eye-splice.

No. 4748.

SAMPLE FROM MANILA COIL NO. 4.

Ends secured to cleats with belaying-pin hitches.
Gauged length, 6 feet.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
1,000	3.30	3.30	.....	Circumference $6\frac{1}{8}$ inches full.
2,000	4.13	.83	.....	Circumference $6\frac{1}{16}$ inches.
3,000	4.92	.79	.....	Circumference 6 inches.
4,000	5.58	.66	.....	Circumference $5\frac{15}{16}$ inches.
5,000	6.23	.65	.....	Circumference $5\frac{7}{8}$ inches.
6,000	6.72	.49	.....	Circumference $5\frac{13}{16}$ inches.
7,000	7.17	.45	.....	Circumference $5\frac{3}{4}$ inches.
8,000	7.72	.55	.....	Circumference $5\frac{11}{16}$ inches full.
9,000	8.06	.34	.....	Circumference $5\frac{5}{8}$ inches full.
10,000	8.46	.40	.....	Circumference $5\frac{5}{8}$ inches; immediate elongation.
.....	8.68	.22	.....	After 5 minutes.
9,000	8.65	— .03	.....	
8,000	8.58	— .07	.....	
7,000	8.54	— .04	.....	
6,000	8.48	— .06	.....	
5,000	8.40	— .08	.....	
4,000	8.23	— .17	.....	
3,000	8.10	— .13	.....	
2,000	7.92	— .18	.....	Circumference $5\frac{11}{16}$ inches.
1,000	7.47	— .45	5.58	Immediate set.
.....	.....	.....	4.88	Set after 5 minutes.
.....	.....	.....	4.60	Set after 15 hours.
1,000	5.57	—1.90	.....	
2,000	6.18	+ .61	.....	
3,000	6.62	.44	.....	
4,000	6.95	.33	.....	
5,000	7.38	.43	.....	
6,000	7.55	.17	.....	
7,000	7.85	.30	.....	
8,000	8.07	.22	.....	
9.000	8.27	.20	.....	
10,000	8.48	.21	.....	Immediate elongation.
.....	8.83	.35	.....	After 5 minutes.
9,000	8.80	— .03	.....	
8,000	8.76	— .04	.....	
7,000	8.68	— .08	.....	
6,000	8.63	— .05	.....	Immediate recovery.
....	8.50	— .13	.....	Recovery after 5 minutes.
				Began to wet the rope.
6,000	8.50	0.	.....	8 minutes after wetting began
6,000	8.62	+ .12	.....	15 minutes after wetting began.
6,000	8.63	.01	.....	32 minutes after wetting began.
6,000	8.66	.03	.....	$1\frac{3}{4}$ hours after wetting began.
6,000	8.67	.01	.....	$2\frac{1}{4}$ hours after wetting began.
6,000	8.65	— .02	.....	$3\frac{1}{4}$ hours after wetting began.
5,000	8.59	— .06	.....	Suspended wetting rope.
4,000	8.56	— .03	.....	
3,000	8.48	— .08	.....	
2,000	8.33	— .15	.....	
1,000	8.00	— .33	6.68	Immediate set.
.....	.....	.....	6.55	Set after 5 minutes.
1,000	6.92	—1.08	.....	
2,000	7.33	+ .41	.....	
3,000	7.64	.31	.....	
4,000	7.83	.19	.....	
5,000	8.01	.18	.....	
6,000	8.17	.16	.....	
7,000	8.35	.18	.....	
8,000	8.48	.13	.....	
9,000	8.61	.13	.....	
10,000	8.74	.13	.....	Immediate elongation.
.....	8.92	.18	.....	After 5 minutes.
9,000	8.89	— .03	.....	
8,000	8.87	— .02	.....	
7,000	8.85	— .02	.....	
6,000	8.83	— .02	.....	
5,000	8.68	— .15	.....	
4,000	8.60	— .08	.....	
3,000	8.52	— .08	.....	

No. 4748—Continued.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
2,000	8.35	— .19	.....	
1,000	7.92	— .41	6.88	Immediate set.
0	.....	.....	6.42	Set after 5 minutes. Circumference 6″. Resumed wetting rope.
0	.....	.....	6.17	After wetting 30 minutes. Circumference 6⅛″ scant.
0	.....	.....	5.90	After wetting 50 minutes.
1,000	6.50	—1.42	.....	Wetting discontinued.
2,000	6.98	+ .48	.....	
3,000	7.40	.42	.....	
4,000	7.68	.28	.....	
5,000	7.90	.22	.....	
6,000	8.17	.27	.....	
7,000	8.32	.15	.....	
8,000	8.50	.18	.....	
9,000	8.72	.22	.....	
10,000	8.93	.21	.....	Circumference 6¾″ scant.
.....	9.12	.19	.....	Elongation after 5 minutes.
9,000	9.07	— .05	.....	
8,000	9.03	— .04	.....	
7,000	8.98	— .05	.....	
6,000	8.93	— .05	.....	
5,000	8.88	— .05	.....	
4,000	8.78	— .10	.....	
3,000	8.57	— .21	.....	
2,000	8.38	— .19	.....	
1,000	7.98	— .40	6.85	Immediate set.
0	.....	.....	6.55	Set after 5 minutes. Circumference 6″ full. Resumed wetting the rope.
.....	.....	.....	6.23	After wetting 30 minutes.
1,000	6.61	—1.37	.....	Wetting discontinued.
2,000	7.17	+ .56	.....	
3,000	7.50	.33	.....	
4,000	7.75	.25	.....	
5,000	7.98	.23	.....	
6,000	8.17	.19	.....	
7,000	8.35	.18	.....	
8,000	8.57	.22	.....	
9,000	8.78	.21	.....	
10,000	9.00	.22	.....	Immediate elongation.
.....	9.20	.20	.....	After 5 minutes.
9,000	9.18	— .02	.....	
8,000	9.10	— .08	.....	
7,000	9.05	— .05	.....	
6,000	8.97	— .08	.....	
.....	8.92	— .05	.....	After 5 minutes.
.....	8.98	+ .06	.....	After 30 minutes.
.....	8.96	— .02	.....	After 1 hour.
				Load remained on 40 hours, during which time it fell from 6,000 to 4,200 pounds.
6,000	8.92	— .04	.....	
5,000	8.82	— .10	.....	
4,000	8.78	— .04	.....	
3,000	8.73	— .05	.....	
2,000	8.54	— .19	.....	
1,000	8.37	— .17	7.25	Immediate set Circumference 5⅞″ scant.
.....	.....	.....	6.52	Set after 5 minutes. Removed from machine and soaked 30 minutes in cold water.
0	.....	.....	—1.4	Circumference 7⅛″.
1,000	1.50	—6.87	.....	
2,000	3.37	+1.87	.....	
3,000	4.90	1.53	.....	
4,009	6.03	1.13	.....	
5,000	6.80	.77	.....	
6,000	7.38	.58	.....	
7,000	7.88	.50	.....	
8,000	8.27	.39	.....	
9,000	8.57	.30	.....	
10,000	8.90	.33	.....	Immediate elongation. Circumference 5¾″ full.
.....	9.45	.55	.....	Elongation after 5 minutes.
9,000	9.42	— .03	.....	
8,000	9.37	— .05	.....	
7,000	9.30	— .07	.....	
6,000	9.23	— .07	.....	Immediate recovery.
.....	9.17	— .06	.....	Recovery after 5 minutes.
.....	9.17	0.	.....	Recovery after 10 minutes.

No. 4748—Continued.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
5,000	9.14	— .03	.....	
4,000	9.07	— .07	.....	
3,000	8.90	— .17	.....	
2,000	8.72	— .18	.....	
1,000	8.40	— .32	6.82	Immediate set. Circumference, $6\frac{1}{8}$".
.....	.....	.....	6.46	Set after 5 minutes.
1,000	6.83	—1.57	.....	
2,000	7.33	+ .50	.....	
3,000	7.64	.31	.....	
4,000	8.00	.36	.....	
5.000	8.30	.30	.....	
6,000	8.58	.28	.....	
7,000	8.80	.22	.....	
8,000	9.00	.20	.....	
9,000	9.14	.14	.....	
10,000	9.40	.26	.....	Immediate elongation.
.....	9.71	.31	.....	After 5 minutes.
.....	9.89	.18	.....	After 13 minutes.
.....	10.06	.17	.....	After 38 minutes.
.....	10.16	.10	.....	After 1 hour and 10 minutes.
.....	10.30	.14	.....	After 2 hours and 30 minutes.
.....	10.50	.20	.....	After 3 hours and 40 minutes.
9,000	10.49	— .01	.....	
8,000	10.46	— .03	.....	
7,000	10.41	— .05	.....	
6,000	10.35	— .06	.....	
5,000	10.30	— .05	.....	
4,000	10.15	— .15	.....	
3,000	10.07	— .08	.....	
2,000	10.00	— .07	.....	
1,000	9.93	— .07	8.70	Immediate set.
.....	.....	.....	8.24	Set after 5 minutes.

Rope removed from machine. Test resumed after rope had been thoroughly dried, and then soaked in water 18 hours. Interval between tests, 5 days.

The gauged length after soaking was 5 feet 6.10 inches, or 5.90 inches less than when originally laid off on the new rope, and 14.14 inches shorter than when the set was last taken.

Elongations measured on original gauged length.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
500	—2.95	+2.95	.....	
1,000	— .50	+2.45	.....	
1,500	+1.12	1.62	.....	
2,000	2.40	1.28	.....	
2,500	3.22	.82	.....	
3,000	3.95	.73	.....	
4,000	5.05	1.10	.....	
5,000	6.07	1.02	.....	
6,000	6.58	.51	.....	
7,000	7.05	.47	.....	
8,000	7.45	.40	.....	
9,000	7.80	.35	.....	
10,000	8.10	.30	.....	
11,000	8.33	.23	.....	
12,000	8.80	.47	.....	
13,000	8.95	.15	.....	
14,000	9.17	.22	.....	
15,000	9.30	.13	.....	Immediate elongation.
.....	9.80	.50	.....	After 5 minutes.
.....	10.15	.35	.....	After 10 minutes.
.....	10.30	.15	.....	After 15 minutes.
.....	10.50	.20	.....	After 25 minutes.
.....	10.89	.39	.....	After 50 minutes,
.....	11.30	.41	.....	After 1 hour and 50 minutes.
10,000	11.07	— .23	.....	
5,000	10.92	— .15	.....	
1,000	10.40	— .52	9.30	Immediate set.
.....	.....	.....	8.50	Set after 5 minutes.
.....	.....	.....	3.00	Set after 6 days. Rope damp inside; outside is dry.
1,000	7.40	—3.00	.....	Test resumed with damp rope, using the same gauged length as before.
2,000	8.20	+ .80	.....	
3,000	8.90	.70	.....	
4,000	9.35	.45	.....	
5,000	9.73	.38	.....	
6,000	10.00	.27	.....	
7,000	10.30	.30	.....	
8,000	10.58	.28	.....	
9,000	10.80	.22	.....	
10,000	10.97	.17	.....	
5,000	10.70	— .27	.....	
1,000	10.05	— .65	9.00	
1,000	9.35	— .70	.....	
2,000	9.68	+ .33	.....	
3,000	10.00	.32	.....	
4,000	10.14	.14	.....	
5,000	10.35	.21	.....	
6,000	10.54	.19	.....	
7,000	10.70	.16	.....	
8,000	10.82	.12	.....	
9,000	10.91	.09	.....	
10,000	11.05	.14	.....	
5,000	10.77	— .28	.....	Immediate elongation.
.....	10.75	— .02	.....	After 5 minutes.
7,000	10.82	+ .07	.....	
8,000	10.95	.13	.....	
9,000	11.07	.12	.....	
10,000	11.13	.06	.....	
11,000	11.25	.12	.....	
12,000	11.34	.09	.....	
13,000	11.45	.11	.....	
14,000	11.64	.19	.....	
15,000	11.75	.11	.....	
16,000	11.82	.07	.....	
17,000	12.03	.21	.....	
18,000	12.10	.07	.....	

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inch.*	*Inch.*	
19,000	12.22	.12	.....	
20,000	12.35	.13	.....	
21,000	12.44	.09	.....	
22,000	12.53	.09	.....	
23,000	12.60	.07	.....	
24,000	12.68	.08	.....	
25,000	12.75	.07	.....	
26,000	12.85	.10	.....	
30,000	13.96	.21	.....	
31,850	.....	.....	.....	Tensile strength.

Parted one strand at the eye-splice.

No. 4748*a*.

The long end of this fractured specimen was prepared with eye-splices in the ends.

The eyes and splices were wet, leaving a dry section between, which was 5½ feet long.

Tensile strength, 30,800 pounds.

Parted one strand near the splice, at the end of the dry section.

No. 4785.

SAMPLE FROM MANILA COIL NO. 4.

Soaked in water 18 hours before testing.
Present circumference, 7½ inches.
Secured by eye-splices in the ends.
Gauged length, 6 feet.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
500	1.90	1.90	.....	
1,000	5.64	3.74	.....	
1,500	8.00	2.36	.....	
2,000	9.70	1.70	.....	
2,500	11.03	1.33	.....	Circumference, 6⅝″.
3,000	12.18	1.15	.....	
3,500	13.15	.97	.....	
4,000	13.84	.69	.....	
5,000	14.94	1.10	.....	
6,000	15.87	.93	.....	
5,000	15.84	— .03	.....	
4,000	15.70	— .14	.....	
3,000	15.52	— .18	.....	
2,000	15.13	— .39	.....	
1,000	14.50	— .63	11.90	Immediate set.
.....	.....	.....	11.73	Set after 5 minutes.
1,000	12.15	—2.35	.....	
2,000	13.10	+ .95	.....	
3,000	14.02	.92	.....	
4,000	14.83	.81	.....	
5,000	15.50	.67	.....	
6,000	16.07	.57	.....	Circumference, 6¼″.
7,000	16.66	.59	.....	
8,000	17.10	.44	.....	
9,000	17.55	.45	.....	
10,000	17.79	.24	.....	
11,000	18.17	.38	.....	
12,000	18.50	.33	.....	
13,000	18.88	.38	.....	
14,000	19.00	.12	.....	
15,000	19.37	.37	.....	
10,000	19.12	— .25	.....	
5,000	18.70	— .42	.....	
1,000	17.68	—1.02	15.75	Immediate set. Circumference, 6⅛″.
.....	.....	.....	15.35	Set after 5 minutes.
5,000	17.60	— .08	.....	
10,000	18.60	+1.00	.....	
15,000	19.40	.80	.....	
16,000	19.70	.30	.....	
17,000	19.90	.20	.....	
18,000	20.10	.20	.....	
19,000	20.40	.30	.....	
20,000	20.67	.27	.....	
21,000	20.78	.11	.....	
22,000	20.93	.15	.....	
23,000	21.05	.12	.....	
24,000	21.30	.25	.....	
25,000	21.40	.10	.....	
26,000	21.55	.15	.....	
27,000	21.80	.25	.....	
28,000	21.95	.15	.....	
29,000	22.10	.15	.....	
30,000	22.23	.13	.....	
36,250	.....	.....	.....	Tensile strength.

Parted 1 strand at the eye-splice.

TENSILE TESTS OF STRANDS AND YARNS FROM HEMP AND MANILA COILS.

STRANDS FROM HEMP COILS.

No. of test.	No. of coil.	Yarns per strand.	Tensile strength.		Location of fracture.
			Total.	Aggregate.	
			Pounds.	*Pounds.*	
4760	1	7	724		At middle.
4761	.....	.....	870	2,689	Do.
4762	.....	.....	1,095		Do.
4763	2	22	2,640		At cleat.
4764	.....	.....	2,910	8,940	At middle.
4765	.....	.....	3,390		Do.
4766	3	50	4,830		8″ from cleat.
4767	.....	.....	6,330	17,570	At cleat.
4768	.....	.....	6,410		Do.
4769	4	98	12,350		At cleat.
4770	.....	.....	10,500	33,230	Do.
4771	.....	.....	10,380		Near the cleat.

YARNS FROM HEMP COILS.

No. of test.	No. of coil.	Yarns per strand.	Tensile strength.		Remarks.
			Total.	Mean.	
			Pounds.	*Pounds.*	
4801	1	7	171		
4802	.....	.....	204	168	
4803	.....	.....	130		
4804	2	22	176		
4805	.....	.....	214	186	
4806	.....	.....	167		
4807	3	50	175		
4808	.....	.....	138	162	
4809	.....	.....	174		
4810	4	98	218		
4811	.....	.....	164	207	
4812	.....	.....	240		
4813	4	98	124		
4814	.....	.....	94	124	Tested wet.
4815	.....	.....	154		

STRANDS FROM MANILA COILS.

No. of test.	No. of coil.	Yarns per strand.	Tensile strength.		Location of fracture.
			Total.	Aggregate.	
			Pounds.	*Pounds.*	
4772	1	7	1,115		At cleat.
4773	.....	.....	1,135	3,420	Do.
4774	.....	.....	1,170		Do.
4775	2	18	3,380		At middle.
4776	.....	.....	3,245	9,185	At cleat.
4777	.....	.....	2,560		At middle.
4778	3	39	6,890		Do.
4779	.....	.....	6,640	19,940	Do.
4780	.....	.....	6,410		Do.
4781	4	76	10,510		Do.
4782	.....	76	11,370	31,080	Do.
4783	.....	77	9,200		Do.

YARNS FROM MANILA COILS.

No. of test.	No. of coil.	Yarns per strand.	Tensile strength.		Remarks.
			Total.	Mean.	
			Pounds.	*Pounds.*	
4816	1	7	156		
4817	.....	.....	142	145	Very little twist in these yarns.
4818	.....	.....	137		
4828	1	7	164		
4829	.....	.....	120	142	Hard twisted.
4819	2	18	196		
4820	.....	.....	248	234	
4821	.....	.....	257		
4822	3	39	253		
4823	.....	.....	168	234	
4824	.....	.....	280		
4830	3	39	310		
4831	.....	.....	95	228	Tested wet.
4832	.....	.....	280		
4825	4	76	210		
4826	.....	77	202	227	
4827	.....	77	268		

NOTE.—Strands from coils No. 1, hemp and mani'a, were from pieces of rope which had not been previously tested; all other strands were from ropes previously tested, but which did not show evidence of injury.

MANILA ROPE MANUFACTURED AT THE BOSTON NAVY-YARD.

Three-stranded rope, fifty-eight yarns per strand.
Lay, one turn in $3\frac{1}{2}''$.
Circumference, $4\frac{1\,1}{1\,6}''$.

[See Report of Tests, 1885, p. 1110, No. 1034, for earlier test.]

No. 4788.

Eyes spliced in each end.
Gauged length, 6 feet.

Applied loads.	In gauged length.			Remarks.
	Elongation.	Successive elongation.	Set.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	
1,000	3.15	3.15	.....	
2,000	4.40	1.25	.....	
3,000	5.70	1.30	.....	
4,000	6.70	1.00	.....	
5,000	7.67	.97	.....	
4,000	7.63	—.04	.....	
1,000	6.90	—.73	4.75	
1,000	5.83	—1.07	.....	
4,000	7.45	+1.62	.....	
5,000	7.87	.42	.....	
6,000	8.42	.55	.....	
7,000	9.10	.68	.....	
8,000	9.72	.62	.....	
9,000	10.27	.55	.....	
10,000	10.93	.66	.....	
8,000	10.80	—.13	.....	
.....	10.92	+.12	.....	After 4 minutes.
5,000	10.68	—.24	.....	
.....	10.68	0.	.....	After 3 minutes.
1,000	9.70	—.98	8.60	
1,000	9.00	—.70	.....	
5,000	10.10	+1.10	.....	
10,000	11.15	1.05	.....	
11,000	11.40	.25	.....	
12,000	11.78	.38	.....	
13,000	12.10	.32	.....	
13,820	.....	.....	.....	Tensile strength.

Parted 1 strand at the splice.

No. 4789.

FROM SAME PIECE OF ROPE AS NO. 4788.

Eye-splice in each end.
The eyes and splices were soaked in water $3\frac{1}{2}$ hours and tested while wet. The middle section, 4 feet long, was not wet.
Tensile strength, 18,700 pounds.
Parted 1 strand at middle of the dry section.

No. 4790.

Eye-splice in each end.
Tensile strength, 10,240 pounds.
Parted 1 strand at the eye-splice.
Two samples from same piece of manila rope.
Three-stranded rope, thirty yarns per strand.
Lay, one turn in $3\frac{1}{8}''$.
Circumference, $3\frac{3}{4}''$.

No. 4791.

Eyes spliced in ends. The eyes and splices were soaked in water and tested while wet.
The middle section, $5\frac{1}{2}$ feet long, was dry.
Tensile strength, 10,480 pounds.
Parted one strand at the end of the dry section.
Two samples from same piece of manila rope.
Three-stranded rope, thirty yarns per strand.
Lay, one turn in $3\frac{1}{8}''$.
Circumference, $3\frac{3}{4}''$.

No. 4792.

Eye-splice in each end.
Tensile strength, 23,450 pounds.
Parted 1 strand 14″ from the eye-splice.
Two samples from same piece of Russia hemp rope.
Three-stranded rope, seventy yarns per strand.
Lay, one turn in $4\frac{1}{4}''$.
Circumference, $4\frac{15}{16}''$.

No. 4793.

Eyes spliced in ends. The eyes and splices were soaked in water and tested while wet.
The middle section, $5\frac{1}{2}$ feet long, was dry.
Tensile strength, 20,050 pounds.
Parted 1 strand at the eye-splice.
Two samples from same piece of Russia hemp rope.
Three-stranded rope, seventy yarns per strand.
Lay, one turn in $4\frac{1}{4}''$.
Circumference, $4\frac{15}{16}''$.

No. 4794.

Eye-splice in each end.
Tensile strength, 10,270 pounds.
Parted 2 strands at the eye-splice.
Two samples from same piece of Russia hemp rope. (See Report of Tests, 1885, page 1112, No. 1042, for earlier test.)
Three-stranded rope, thirty-two yarns per strand.
Lay, one turn in $3\frac{1}{4}''$.
Circumference, $3\frac{1}{2}''$.

No. 4795.

Eye splice in each end. The eyes and splices soaked in water and tested while wet.

The middle section, 7 feet long, was dry.

Tensile strength, 11,380 pounds.

Square break at middle of the dry section.

Two samples from same piece of Russia hemp rope. (See Report of Tests, 1885, page 1112, No. 1042, for earlier test.)

Three-stranded rope, thirty-two yarns per strand.

Lay, one turn in $3\frac{1}{4}''$.

Circumference, $3\frac{1}{2}''$.

No. 4747.

A strap composed of 206 yarns of manila, taken from a lot of rope tested for the light house inspector, third district.

Total length of strap, $24\frac{1}{2}$ feet, or when double, $12\frac{1}{4}$ feet.

The yarns were laid straight, and held in place with service of same kind of yarns.

Tested over cleats; thus the two parts of the strap were strained at the same time, in all 412 yarns.

A gauged length of 6 feet on each part established.

Total load.	Elongation, part A.		Elongation, part B.		Remarks.
	Total.	Successive.	Total.	Successive.	
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
4,000	1.20	1.20	1.00	1.00	
8,000	1.30	.10	1.15	.15	
12,000	1.45	.15	1.25	.10	
16,000	1.60	.15	1.35	.10	
12,000	1.55	— .05	1.37	.02	
8,000	1.53	— .02	1.35	— .02	
4,000	1.42	— .11	1.28	— .07	
16,000	1.60	+ .18	1.42	+ .14	
20,000	1.68	.08	1.48	.06	
Load released and strap hauled around one quarter way; the places which were over the cleats are now midway between them.					
23,300	.....	.....	.....	.....	Tensile strength.

The strap parted in vicinity of places which were over the cleats before hauling around.

TABULATION OF TESTS OF HEMP AND MANILA ROPE, SHOWING STRENGTH OF PLAIN ROPE AND HITCHES, KNOTS, AND SPLICES.

TARRED HEMP ROPE, COIL NO. 1.

Three stranded rope, seven yarns per strand.
Lay, one turn in 1″.3.
Circumference, 1″.8. Weight per fathom, 10.4 ounces.

No. of test.	Hitches, knots, or splices used.	Elongation in 6 feet.	Tensile strength.	Location of fracture.	Remarks.
		Inches.	*Pounds.*		
4712	Belaying-pin hitches	.....	2,570	At cleat	
4696	....do	9.70	2,200	18″ from cleat	
4697	....do	10.50	1,940	At middle	Wet during the test.
4698	....do	11.17	2,230	At cleat	Wet with warm water.
4699	....do	10.58	2,300	....do	Soaked 2 hours in water.
4700	Bowline at one end, belaying-pin hitch at other.	.....	2,235	At bowline knot	
4701	Bowline at one end, belaying-pin hitch at other.	.....	2,365	....do	
4702	Mooring hitch at one end, belaying-pin hitch at other.	.....	2,140	At mooring hitch.	
4703	Clove hitch at one end, belaying-pin hitch at other.	.....	800	Clove hitch unrolled.	
4704	Clove hitch and two half hitches at one end, belaying-pin hitch at other.	.....	2,490	At clove hitch	
4705	Two half hitches at one end, belaying-pin hitch at other.	.....	2,190	18″ from hitch	
4711	Timber hitch at one end, belaying-pin hitch at other.	.....	1,965	At timber hitch	
4887	Eye-splice at one end, belaying-pin hitch at other.	.....	1,820	At eye-splice	
4888	Belaying-pin hitches at ends, short splice at middle.	.....	2,490	At the cleat	
4787	Eye splices at ends, short splice at middle.	.....	1,960	At short splice	Soaked 2½ days in water.
4706	Belaying-pin hitches at ends, square knot at middle.	.....	1,665	At knot	
4708	....do	.....	1,548	....do	
4707	Belaying-pin hitches at ends, square knot at middle, with ends stopped back.	.....	2,205	....do	
4709	Belaying-pin hitches at ends, single Garrick bend at the middle with ends stopped.	.....	2,158	10″ outside the bend.	
4710	Belaying-pin hitches at ends, double Garrick bend at the middle.	.....	2,010	At bend	

Tarred Hemp Rope, Coil No. 2.

Three-stranded rope, twenty-two yarns per strand.
Lay, one turn in 2″.7.
Circumference, 3″.2. Weight per fathom 1 pound 15¾ ounces.

No. of test.	Hitches, knots, or splices used.	Elongation in 6 feet.	Tensile strength.	Location of fracture.	Remarks.
		Inches.	*Pounds.*		
4717	Belaying-pin hitches at ends	.....	6,560	At cleat	
4714	Belaying-pin hitches at ends, square knot at middle.	.....	4,260	At knot	
4716	....do	.....	4,885	....do	
4715	Belaying-pin hitches at ends, square knot at middle, with ends stopped.	.....	6,470	At cleat	
4718	Belaying-pin hitches at ends, square knot at middle, wet with hot water.	.....	4,850	At knot	
4719	....do	.....	3,340	....do	
4886	Belaying-pin hitches at ends, short splice at middle.	.....	6,810	At cleat	
4720	Belaying-pin hitch at one end, eye-splice at other end.	.....	6,670	At eye-splice	
4745	Eye-splice in each end	10.33	6,320	....do	
4786	....do	.....	6,050	....do	Soaked in water 2½ days.
4752	Round turn and two half hitches at each end.	.....	7,780	At hitches	
4753	....do	.....	7,150	Between hitches and cleat.	

Tarred Hemp Rope, Coil No. 3.

Three-stranded rope, fifty yarns per strand.
Lay, one turn in 3¾″.
Circumference, 4⅞″. Weight per fathom, 4 pounds 9 ounces.

No. of test.	Hitches, knots, or splices used.	Elongation in 6 feet.	Tensile strength.	Location of fracture.	Remarks.
		Inches.	*Pounds.*		
4721	Belaying-pin hitches at ends	.....	13,980	At cleat	
4722	Belaying-pin hitches at ends, square knot at middle.	.....	11,470	At knot	
4723	Belaying-pin hitches at ends, single Garrick bend at middle, with ends stopped.	.....	15,800	At cleat	
4884	Belaying-pin hitches at ends, short splice at middle.	.....	14,100	....do	
4750	Belaying-pin hitch at one end, bowline at other end.	.....	9,180	At bowline	
4883	Belaying-pin hitch at one end, eye-splice at other end.	.....	15,680	At cleat	
4751	Belaying-pin hitch at one end, round turn and two half hitches at other end.	.....	14,500	....do	
4743	Eye-splice in each end	10.58	16,900	At eye-splice	

Tarred Hemp Rope, Coil No. 4.

Three-stranded rope, ninety-eight yarns per strand.
Lay, one turn in $4\frac{1}{2}''$.
Circumference, $6\frac{1}{2}''$. Weight per fathom, 9 pounds 6 ounces.

No. of test.	Hitches, knots, or splices used.	Elongation in 6 feet.	Tensile strength.	Location of fracture.	Remarks.
		Inches.	*Pounds.*		
4727	Belaying-pin hitches at ends	10.68	21,680	At cleat	
4724	do		19,800	do	
4725	Belaying-pin hitches at ends, square knot at middle.		17,400	At knot	
4726	Belaying-pin hitches at ends, single Garrick bend at middle with ends stopped.		20,050	At bend	
4885	Belaying-pin hitches at ends, short splice at middle.		21,180	At cleat	
4749	Belaying-pin hitch at one end, bowline at other end.		16,250	At bowline	
4748	Belaying-pin hitch at one end, eye splice at other end.		18,950	At eye-splice	
4741	Eye-splice in each end.	10.20	23,000	do	

Manila Rope, Coil No. 1.

Three-stranded rope, seven yarns per strand.
Lay, one turn in 1″.66.
Circumference, 1.″50. Weight per fathom, 6.63 ounces.

No. of test.	Hitches, knots, or splices used.	Elongation in 6 feet.	Tensile strength.	Location of fracture.	Remarks.
		Inches.	*Pounds.*		
4740	Belaying-pin hitches at ends		2,270	At cleat	
4736	Belaying-pin hitches at ends, short splice at middle.		2,210	At splice	
4732	Eye-splice in each end		2,240	At cleat	

Manila Rope, Coil No. 2.

Three-stranded rope, eighteen yarns per strand.
Lay, one turn in $2\frac{3}{4}''$.
Circumference, $2\frac{7}{8}''$. Weight per fathom, 1 pound 7 ounces.

No. of test.	Hitches, knots, or splices used.	Elongation in 6 feet.	Tensile strength.	Location of fracture.	Remarks.
		Inches.	*Pounds.*		
4739	Belaying-pin hitches at ends		6,250	At cleat	
4735	Belaying-pin hitches at ends, short splice at middle.		6,720	do	
4731	Eye-splice in each end		7,780	do	
4746	do	12.38	7,000	3 feet from eye-splice.	
4758	Round turn and two half hitches at each end.		6,120	At the hitch	
4759	do		8,500	do	Tested wet.

MANILA ROPE, COIL NO. 3.

Three-stranded rope, thirty-nine yarns per strand.
Lay, one turn in 4″.
Circumference, 4′$\frac{1}{16}$. Weight per fathom, 3 pounds 4$\frac{1}{2}$ ounces.

No. of test.	Hitches, knots, or splices used.	Elongation in 6 feet.	Tensile strength.	Location of fracture.	Remarks.
		Inches.	*Pounds.*		
4738	Belaying-pin hitches at ends	.....	14,900	At the cleat	
4734	Belaying-pin hitches at ends, short splice at middle.	.....	14,850	At the splice	
4730	Eye-splice in each end	.....	14,550	At the cleat	
4744	....do	12.20	14,750	At the eye-splice	
4784	....do	.....	17,280	....do	Soaked in water 24 hours.
4756	Round turn and two half hitches at each end.	.....	14,750	At the hitches	
4757	....do	.....	21,800	....do	Tested wet.

MANILA ROPE, COIL NO. 4.

Three-stranded rope, seventy-seven yarns per strand.
Lay, one turn in 5$\frac{1}{2}$″.
Circumference 6$\frac{1}{2}$″. Weight per fathom, 6 pounds 9.4 ounces.

No. of test.	Hitches, knots, or splices used.	Elongation in 6 feet.	Tensile strength.	Location of fracture.	Remarks.
		Inches.	*Pounds.*		
4737	Belaying-pin hitches at ends	.....	25,560	At the cleat	
4733	Belaying-pin hitches at ends, short splice at middle.	.....	26,400	At the splice	
4755	Belaying-pin hitches at ends, buntline bend at middle.	.....	15,400	At the bend	
4754	Belaying-pin hitch at one end, bowline at other end.	.....	17,560	At the bowline	
4729	Eye-splice in each end	.....	27,800	At the cleat	
4742	....do	11.70	26,000	At the eye-splice	
4748	....do	13.06	31,850	....do	Wet during the test.
4748*a*	....do	.....	30,800	Near eye-splice at end of dry section.	Eye-splices wet, remainder of rope dry.
4785	....do	22.23	36,250	At the eye-splice	Soaked in water 18 hours.

TABULATION OF MANILA AND RUSSIA HEMP ROPE, MANUFACTURED AT BOSTON NAVY-YARD.

[Secured to cleats by eye-splices in ends.]

No. of test.	Kind of rope.	Description.				Elongation in 6 feet.	Tensile strength.	Location of fracture.	Remarks.
		Circumference.	Strands.	Yarns per strand.	Lay, one turn in—				
		Inches.			*Inches.*	*Inches.*	*Pounds.*		
4788	Manila	$4\frac{11}{16}$	3	58	$3\frac{1}{2}$	12.10	13,820	At eye-splice	
4789							18,700	At middle of dry section	Eyes and splices soaked in water $3\frac{1}{2}$ hours.
4790	do	$3\frac{3}{4}$	3	30	$3\frac{1}{8}$		10,240	At eye-splice	
4791							10,480	At end of dry section	Eyes and splices soaked in water.
4792	Russia hemp	$4\frac{15}{16}$	3	70	$4\frac{1}{4}$		23,450	14″ from eye-splice	
4793							20,050	At the eye-splice	Do.
4794	do	$3\frac{1}{2}$	3	32	$3\frac{1}{4}$		10,270	do	
4795							11,380	At middle of dry section	Do.

Two samples of manila and two samples of hemp rope, each taken from the same coil.

One sample of each was alternately wet and dried five times; the duplicate samples were tested without having been wet.

Samples were 8 to 9 feet long each; they were prepared with eye-splices in the ends. The splices were wet at the time of testing, having a dry section of rope between the eyes about 4 to 5 inches long.

No. of test.	Kind of rope.	Description.				Tensile strength.	Parted.	Remarks.
		Circumference.	Strands.	Yarns per strand.	Lay, one turn in—			
		Inches.			*Inches.*	*Pounds.*		
5235	Manila	$4\frac{5}{8}$	3	46	$3\frac{5}{8}$	15,150	1 strand at middle of the length	
5236	do	$5\frac{1}{8}$	3	46	$3\frac{3}{4}$	14,380	do	Had been wet and dried five times.
5237	Hemp	$4\frac{3}{4}$	3	47	$3\frac{3}{4}$	11,020	1 strand at the eye-splice	
5238	do	$5\frac{1}{4}$	3	47	4	10,500	do	Do.

MANILA HEMP AND WIRE ROPE FOR BUREAU OF EQUIPMENT, U. S. NAVY DEPARTMENT.

All of this material was made at the Boston navy-yard.
Ends have thimbles turned in, four seizings at each end.
Rope 24″ long between served ends.

MANILA ROPE, 3 STRANDS.

No. of test.	Circumference.	Yarns per strand.	Lay, one turn in—	Tensile strength.	Parted.
	Inches.		*Inches.*	*Pounds.*	1 strand.
4384	$1\frac{15}{16}$	10	$2\frac{1}{4}$	4,284	Do.
4385	$1\frac{15}{16}$	.....	.....	4,370	Do.
4386	$1\frac{15}{16}$	.....	.....	4,278	Do.
4387	$2\frac{3}{8}$	13	$2\frac{3}{4}$	5,280	Do.
4388	$2\frac{3}{8}$	.....	.....	5,510	Do.
4389	$2\frac{3}{8}$	.....	.....	6,070	Do.
4390	$2\frac{9}{16}$	16	3	6,560	Do.
4391	$2\frac{9}{16}$	.....	.....	6,715	Do.
4392	$2\frac{9}{16}$	.....	.....	6,955	Do.
4393	$2\frac{13}{16}$	19	3	8,665	Do.
4394	$2\frac{13}{16}$	.....	.....	8,320	Do.
4395	$2\frac{13}{16}$	.....	.....	8,618	Do.
4396	3	24	3	10,775	Do.
4397	3	.....	.....	11,225	Do.
4398	3	.....	.....	10,520	Do.
4399	$3\frac{5}{16}$	28	$3\frac{1}{4}$	10,890	Do.
4400	$3\frac{5}{16}$	.....	.....	11,670	Do.
4401	$3\frac{5}{16}$	.....	.....	11,640	Do.
4402	$3\frac{1}{2}$	25	$3\frac{3}{8}$	11,120	Do.
4403	$3\frac{1}{2}$	.....	.....	13,160	Do.
4404	$3\frac{1}{2}$	.....	.....	11,570	Do.
4405	$3\frac{7}{8}$	28	$3\frac{1}{2}$	12,330	Do.
4406	$3\frac{7}{8}$	.....	.....	11,640	Do.
4407	$3\frac{7}{8}$	.....	.....	12,510	Do.
4408	$4\frac{1}{4}$	31	$3\frac{7}{8}$	14,910	Do.
4409	$4\frac{1}{4}$	.....	.....	13,630	Do.
4410	$4\frac{1}{4}$	.....	.....	16,020	Do.
4411	$4\frac{5}{8}$	36	$4\frac{1}{8}$	15,690	Do.
4412	$4\frac{5}{8}$	.....	.....	15,340	Do.
4413	$4\frac{5}{8}$	.....	.....	16,070	Do.
4414	$4\frac{5}{8}$	41	4	15,850	Do.
4415	$4\frac{5}{8}$	.....	.....	16,420	Do.
4416	$4\frac{5}{8}$	.....	.....	14,840	Do.
4417	5	45	$4\frac{1}{4}$	19,020	Do.
4418	5	.....	.....	19,370	2 strands at throat seizing.
4419	5	.....	.....	19,490	1 strand.
4420	$5\frac{1}{4}$	50	$4\frac{1}{4}$	19,230	Do.
4421	$5\frac{1}{4}$	.....	.....	21,510	Do.
4422	$5\frac{1}{4}$	.....	.....	21,200	Do.
4423	$5\frac{5}{8}$	57	$4\frac{1}{2}$	22,980	Do.
4424	$5\frac{5}{8}$	.....	.....	21,620	Do.
4425	$5\frac{5}{8}$	.....	.....	22,450	Do.
4426	$5\frac{15}{16}$	63	5	26,790	Do.
4427	$5\frac{15}{16}$	.....	.....	26,970	Do.
4428	$5\frac{15}{16}$	.....	.....	26,460	Do.
4429	6	68	5	27,990	Do.
4430	6	.....	.....	29,500	Do.
4431	6	.....	.....	26,990	Do.
4432	$6\frac{1}{2}$	75	$5\frac{1}{2}$	31,900	Do.
4433	$6\frac{1}{2}$	.....	.....	32,150	Do.
4434	$6\frac{1}{2}$	.....	.....	31,000	1 strand. This strand had been cut prior to testing.
4438	$6\frac{5}{8}$	93	$5\frac{1}{8}$	30,400	1 strand.
4439	$6\frac{5}{8}$	.....	.....	30,050	Do.
4440	$6\frac{5}{8}$	.....	.....	31,480	Do,
4435	$6\frac{3}{4}$	81	.....	33,780	Do.
4436	$6\frac{3}{4}$	.....	.....	33,020	Do.
4437	$6\frac{3}{4}$	.....	.....	33,370	Do.
4441	$7\frac{1}{4}$	108	.....	38,800	1 strand under the seizing.
4442	$7\frac{1}{4}$	.....	.....	37,450	1 strand.
4443	$7\frac{1}{4}$	.....	.....	38,790	Do.
4444	$8\frac{5}{16}$	124	.....	44,650	Do.
4445	$8\frac{5}{16}$	.....	.....	41,600	At throat seizing.
4446	$8\frac{5}{16}$	.....	.....	47,100	1 strand.
4447	$8\frac{1}{2}$	143	.....	55,150	Do.
4448	$8\frac{1}{2}$	.....	.....	54,270	Do.
4449	$8\frac{1}{2}$	.....	.....	52,920	Do.
4450	9	160	.....	48,100	At thimble.
4451	9	.....	.....	48,700	Do.
4452	9	.....	.....	50,450	1 strand.

MANILA ROPE, 3 STRANDS—Continued.

[Throat seizing, wire.]

No. of test.	Circumference.	Yarns per strand.	Lay, one turn in—	Tensile strength.	Parted.
	Inches.		*Inches.*	*Pounds.*	
4453	9 7/8	180	7 3/8	60,820	1 strand.
4454	9 7/8	.....	.....	56,100	Do.
4455	9 7/8	.....	.....	59,300	1 strand under clamps.
4456	11 3/8	199	8 3/4	73,900	Under the seizing.
4457	11 3/8	.....	.....	77,050	At thimble.
4458	11 3/8	.....	.....	74,400	Under the seizing.

[All wire seizings.]

4459	11 7/8	220	8 1/2	79,900	1 strand under the seizing.
4460	11 7/8	.....	.....	87,200	1 strand.
4461	11 7/8	.....	.....	85,300	Do.

HEMP ROPE, 3 STRANDS.

4462	1 15/16	11	2 3/8	4,248	3 strands.
4463	1 15/16	.....	.....	4,444	Do.
4464	1 15/16	.....	.....	4,020	1 strand.
4465	2 3/8	14	2 1/2	4,750	Do.
4466	2 3/8	.....	.....	4,897	Do.
4467	2 3/8	.....	.....	4,985	Do.
4468	2 1/2	17	2 3/4	5,182	Do.
4469	2 1/2	.....	.....	5,305	Do.
4470	2 1/2	.....	.....	5,890	Do.
4471	2 11/16	22	2 3/4	7,948	Do.
4472	2 11/16	.....	.....	8,075	Do.
4473	2 11/16	.....	.....	7,700	3 strands behind first seizing.
4474	2 15/16	26	3	10,630	3 strands.
4475	2 15/16	.....	.....	9,290	1 strand.
4476	2 15/16	.....	.....	9,320	Do.
4477	3 7/16	32	3 3/8	11,810	2 strands.
4478	3 7/16	.....	.....	11,670	Do.
4479	3 7/16	.....	.....	10,640	1 strand.
4480	3 9/16	35	3 3/4	12,950	2 strands.
4481	3 9/16	.....	.....	13,140	Do.
4482	3 9/16	.....	.....	11,910	1 strand.
4483	3 7/8	41	3 7/8	15,090	Do.
4484	3 7/8	.....	.....	13,640	Do.
4485	3 7/8	.....	.....	14,330	Do.
4486	4	46	3 7/8	15,580	Do.
4487	4	.....	.....	12,950	Do.
4488	4	.....	.....	15,190	Do.
4489	4 1/8	54	4 1/4	15,280	Do.
4490	4 1/8	.....	.....	17,720	Do.
4491	4 1/8	.....	.....	14,620	Do.
4492	4 1/2	60	4 1/2	19,000	Do.
4493	4 1/2	.....	.....	18,020	Do.
4494	4 1/2	.....	.....	17,950	Do.
4495	4 7/8	68	4	19,980	Do.
4496	4 7/8	.....	.....	20,010	Do.
4497	4 7/8	.....	.....	19,360	2 strands.
4498	5 1/16	74	4 1/2	24,630	1 strand.
4499	5 1/16	.....	.....	25,100	Do.
4500	5 1/16	.....	.....	25,060	Do.
4501	5 3/8	82	5 1/4	28,440	Do.
4502	5 3/8	.....	.....	27,070	Do.
4503	5 3/8	.....	.....	27,590	2 strands.
4504	5 5/8	88	5 3/8	32,160	Do.
4505	5 5/8	.....	.....	31,150	1 strand.
4506	5 5/8	.....	.....	29,820	Do.
4507	5 7/8	100	5 1/2	31,490	Do
4508	5 7/8	.....	.....	31,010	Do.
4509	5 7/8	.....	.....	30,850	Do.
4510	6 3/8	108	5 3/4	35,020	Do.
4511	6 3/8	.....	.....	35,200	Do.
4512	6 3/8	.....	.....	35,740	2 strands.
4513	6 9/16	120	5 1/2	39,120	1 strand.
4514	6 9/16	.....	.....	39,100	Do.
4515	6 9/16	.....	.....	38,210	Do.

HEMP ROPE, 4 STRANDS.

No. of test.	Circumference.	Yarns per strand.	Lay, one turn in—	Tensile strength.	Parted.
	Inches.		*Inches.*	*Pounds.*	
4516	$1\frac{3}{16}$	7	$1\frac{1}{8}$	2,760	1 strand.
4517	$1\frac{3}{16}$	.....	.....	2,490	Do.
4518	$1\frac{3}{16}$	.....	.....	2,910	2 strands.
4519	$2\frac{1}{8}$	12	$2\frac{1}{4}$	3,240	1 strand.
4520	$2\frac{1}{8}$	.....	.....	3,168	3 strands.
4521	$2\frac{1}{8}$	.....	.....	3,085	2 strands.
4522	$2\frac{1}{8}$	12	$2\frac{3}{8}$	4,349	Do.
4523	$2\frac{1}{8}$	.....	.....	4,414	1 strand.
4524	$2\frac{1}{8}$	.....	.....	4,364	4 strands.
4525	$2\frac{7}{8}$	15	3	6,792	2 strands.
4526	$2\frac{7}{8}$	.....	.....	5,580	1 strand.
4527	$2\frac{7}{8}$	.....	.....	6,442	2 strands.
4528	$2\frac{13}{16}$	17	$2\frac{7}{8}$	6,820	1 strand.
4529	$2\frac{13}{16}$	.....	.....	6,910	Do.
4530	$2\frac{13}{16}$	.....	.....	7,800	Do.
4531	$3\frac{1}{16}$	19	$2\frac{7}{8}$	8,460	2 strands.
4532	$3\frac{1}{16}$	.....	.....	7,770	1 strand.
4533	$3\frac{1}{16}$	.....	.....	8,050	Do.
4534	$3\frac{7}{16}$	26	$3\frac{1}{2}$	12,340	Do.
4535	$3\frac{7}{16}$	.....	.....	12,580	Do.
4536	$3\frac{7}{16}$	.....	.....	12,450	2 strands.
4537	$3\frac{9}{16}$	27	$3\frac{3}{8}$	8,760	Do.
4538	$3\frac{9}{16}$	.....	.....	9,040	4 strands.
4539	$3\frac{9}{16}$	.....	.....	8,150	2 strands.
4540	$3\frac{13}{16}$	35	4	17,030	Do.
4541	$3\frac{13}{16}$	.....	.....	14,600	1 strand.
4542	$3\frac{13}{16}$	.....	.....	17,160	2 strands.
4543	$4\frac{1}{16}$	35	$3\frac{3}{4}$	13,040	Do.
4544	$4\frac{1}{16}$	.....	.....	12,680	Do.
4545	$4\frac{1}{16}$	.....	.....	13,050	Do.
4546	$4\frac{3}{8}$	45	$4\frac{3}{8}$	20,030	Do.
4547	$4\frac{3}{8}$	.....	.....	20,820	Do.
4548	$4\frac{3}{8}$	.....	.....	20,250	Do.
4549	$4\frac{11}{16}$	50	5	22,650	1 strand.
4550	$4\frac{11}{16}$	.....	.....	19,970	Do.
4551	$4\frac{11}{16}$	.....	.....	20,660	Do.
4552	5	56	$4\frac{7}{8}$	22,500	2 strands under the seizing.
4553	5	.....	.....	22,760	1 strand.
4554	5	.....	.....	24,180	Do.
4609	$5\frac{1}{8}$	62	5	26,320	Do.
4610	$5\frac{1}{8}$	.....	.....	28,250	Do.
4611	$5\frac{1}{8}$	.....	.....	26,290	Do.
4555	$5\frac{3}{16}$	54	$4\frac{7}{8}$	19,090	4 strands.
4556	$5\frac{3}{16}$	.....	.....	20,030	2 strands.
4557	$5\frac{3}{16}$	.....	.....	18,370	4 strands.
4612	$5\frac{3}{8}$	68	$5\frac{1}{2}$	29,400	1 strand at thimble.
4613	$5\frac{3}{8}$	.....	.....	30,950	2 strands.
4614	$5\frac{3}{8}$	.....	.....	28,010	1 strand.
4558	$5\frac{7}{8}$	.....	$5\frac{1}{2}$	32,800	At thimble.
4559	$5\frac{7}{8}$	.....	.....	32,050	1 strand under the seizing.
4560	$5\frac{7}{8}$	.....	.....	31,100	At thimble.
4564	6	84	$5\frac{1}{8}$	36,980	2 strands.
4565	6	.....	.....	34,970	2 strands at thimble.
4566	6	.....	.....	36,920	2 strands.
4561	$6\frac{3}{16}$	84	$5\frac{1}{2}$	36,280	4 strands at thimble.
4562	$6\frac{3}{16}$	.....	.....	35,520	2 strands at thimble.
4563	$6\frac{3}{16}$	.....	.....	36,100	Do.

STEEL WIRE ROPE, 6 STRANDS, WITH HEMP CORE.

No. of test.	Circumference.	Wires per strand.	Lay. one turn in—	Tensile strength.	Parted.
	Inches.		*Inches.*	*Pounds.*	
4567	1	7	2½	8,020	3 strands.
4568	1	.....	.....	7,810	Do.
4569	1	.....	.....	7,890	4 strands.
4570	1 3/16	7	3	9,830	3 strands.
4571	1 3/16	.....	.....	10,270	5 strands.
4572	1 3/16	.....	.....	9,980	4 strands.
4573	1½	18	3½	15,490	3 strands.
4574	1½	.....	.....	15,210	4 strands.
4575	1½	.....	.....	15,290	3 strands.
4576	1 1/16	18	4¼	18,610	4 strands.
4577	1 1/16	.....	.....	18,570	Do.
4578	1 1/16	.....	.....	18,640	Do.
4579	2 1/16	18	4	25,700	Do.
4580	2 1/16	.....	.....	25,680	Do.
4581	2 1/16	.....	.....	25,540	Do.
4582	2 5/16	18	5½	34,050	3 strands.
4583	2 5/16	.....	.....	34,280	Do.
4584	2 5/16	.....	.....	34,640	Do.
4585	2 9/16	18	5¼	35,300	At thimble.
4586	2 9/16	.....	.....	39,400	1 strand.
4587	2 9/16	.....	.....	38,980	4 strands.
4588	2¾	18	6	42,430	3 strands.
4589	2¾	.....	.....	41,870	2 strands.
4590	2¾	.....	.....	43,150	1 strand.
4591	2 5/16	18	5¾	47,410	Do.
4592	2 5/16	.....	.....	48,060	3 strands.
4593	2 5/16	.....	.....	46,320	Do.
4594	3	18	7¼	57,260	Do.
4595	3	.....	.....	58,410	4 strands.
4596	3	.....	.....	58,240	Do.
4597	3 3/8+	18	8	62,700	3 strands.
4598	3 3/8+	.....	.....	60,870	2 strands.
4599	3 3/8+	.....	.....	62,640	1 strand.
4600	3¾	18	8½	83,250	3 strands.
4601	3¾	.....	.....	83,470	4 strands.
4602	3¾	.....	.....	84,010	Do.
4603	4	18	9	89,750	1 strand.
4604	4	.....	.....	85,590	At the thimble.
4605	4	.....	.....	88,980	4 strands.

IRON-WIRE ROPE.

4606	4 9/16	18	9½	61,080	3 strands.
4607	4 9/16	.....	.....	60,490	Do.
4608	4 9/16	.....	.....	60,050	1 strand.

MATERIAL USED FOR SEIZINGS.

No. of test.	Material.	Circumference.	Wires or yarns per strand.	Lay, one turn in—	Tensile strength.	Parted.
		Inches.		*Inches.*	*Pounds.*	
4624	Wire	$\frac{3}{16}$	7		210	
4625	....do	$\frac{3}{16}$			212	
4626	....do	$\frac{3}{16}$			210	
4621	....do	$\frac{2}{8}$	19		609	
4622	....do	$\frac{2}{8}$			598	
4623	....do	$\frac{2}{8}$			595	
4618	....do	$\frac{7}{16}$	19		937	
4619	....do	$\frac{7}{16}$			928	
4620	....do	$\frac{7}{16}$			920	
4615	....do	$\frac{1}{2}$ +	18		948	
4616	....do	$\frac{1}{2}$ +			1,002	
4617	....do	$\frac{1}{2}$ +			1,022	
4636	Hemp, 4-thread	$\frac{3}{4}$	2		490	1 strand.
4637	....do	$\frac{3}{4}$			424	Do.
4638	....do	$\frac{3}{4}$			398	Do.
4633	Hemp, 6-thread	$\frac{3}{4}$	2		462	Do.
4634	....do	$\frac{3}{4}$			554	Do.
4635	....do	$\frac{3}{4}$			459	Do.
4630	Hemp, 9-thread	1	3		964	Do.
4631	....do	1			855	Do.
4632	....do	1			905	Do.
4627	Hemp, 12-thread	$1\frac{1}{8}$	4		1,480	Do.
4628	....do	$1\frac{1}{8}$			1,250	Do.
4629	....do	$1\frac{1}{8}$			1,375	Do.

RATLINE.

4645	Hemp, 15-thread	$1\frac{5}{16}$	5	$1\frac{5}{16}$	1,345	1 strand.
4646	....do	$1\frac{5}{16}$			1,495	Do.
4647	....do	$1\frac{5}{16}$			1,348	Do.
4642	Hemp, 18-thread	$1\frac{9}{16}$	6	$1\frac{3}{8}$	1,930	2 strands.
4643	....do	$1\frac{9}{16}$			1,670	1 strand.
4644	....do	$1\frac{9}{16}$			1,964	Do.
4639	Hemp, 21-thread	$1\frac{11}{16}$	7	$1\frac{3}{4}$	1,730	Do.
4640	....do	$1\frac{11}{16}$			1,986	2 strands.
4641	....do	$1\frac{11}{16}$			1,884	Do.

PRESSURE GAUGES.

Comparison of two 12-inch and one 6-inch pressure gauges with testing machine gauge No. 13, for U. S. S. *Vesuvius*.

Gauges manufactured by the American Steam Gauge Company, Boston, Mass.

[Gauge readings.]

Testing machine gauge No. 13.	12-inch gauge No. 207971.		12-inch gauge No. 207,972.		6-inch gauge No. 207317.	
	Upward.	Downward.	Upward.	Downward.	Upward.	Downward.
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
50	.....	.....	.....	.....	75	.....
100	.....	.....	.....	.....	130	.....
200	.....	.....	.....	.....	250	.....
	.....	.....	.....	.....	260	.....
300	.....	.....	.....	.....	360	.....
350	.....	406	.....	.....	.....	.....
400	450	454	408	415	485	.....
			417	413	.....	.....
450	503	.....	458	.....	.....	.....
500	556	560	514	.....	555	.....
			518	.....	.....	.....
550	606	.....	550	.....	.....	.....
			569	.....	.....	.....
600	661	.....	618	.....	700	.....
			621	.....	.....	.....
650	714	.....	664	.....	.....	.....
			671	.....	.....	.....
700	764	.....	718	.....	845	.....
			722	.....	.....	.....
750	815	819	767	776	.....	.....
			771	769	.....	.....
800	872	.....	824	.....	960	.....
			827	.....	.....	.....
850	924	.....	874	.....	.....	.....
			880	.....	.....	.....
900	975	.....	928	.....	1,060	.....
			936	.....	.....	.....
950	1,020	.....	981	.....	.....	.....
			990	.....	.....	.....
1000	1,073	.....	1,022	.....	1,185	1,190
			1,036	.....	.....	1,180
1100	.....	.....	.....	.....	1,280	.....
1200	.....	.....	.....	.....	1,380	.....
1300	.....	.....	.....	.....	1,500	.....
1400	.....	.....	.....	.....	1,620	.....
1500	.....	.....	.....	.....	1,725	.....
1600	.....	.....	.....	.....	1,840	.....
1700	.....	.....	.....	.....	1,925	.....
1800	.....	.....	.....	.....	2,030	.....
1900	.....	.....	.....	.....	2,130	.....
2000	.....	.....	.....	.....	2,270	.....
					2,280	.....

Where two gauge readings occur under the same pressure, as indicated by the testing machine gauge, the second reading was obtained after jarring the gauge being compared.

PRIVATE TESTS.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1890.				
July 11	Steel plate	F. A. Houdlette & Co	Boston	Mass.
	....do	Wm. Allen & Sons	Worcester	Mass.
	....do	Cunningham Iron Works Co.	Charlestown	Mass.
14	Iron and steel bars, electrically welded.	Thomson Electric Welding Co.	Lynn	Mass.
15	Brass and bronze	Cowles, E. S. & Al. Co	Lockport	N. Y.
18	Railroad rail joint	The Weber Railway Joint Manufacturing Co.	New York	N. Y.
21	Steel plate	Cunningham Iron Works Co.	Charlestown	Mass.
28	Steel bars	Thomson-Houston Electric Co.	Lynn	Mass.
	Wrought-iron bar	Boston Bolt Co	Boston	Mass.
29	Steel plate	Geo. H. Lloyd	....do	Mass.
	....do	Edward Kendall & Sons	Cambridgeport	Mass.
31	....do	Cunningham Iron Works Co.	Charlestown	Mass.
Aug. 5	Railroad rail joint	Standard Railway Rail-joint Co.	Boston	Mass.
6	Wrought-iron plate	Cunningham Iron Works Co.	Charlestown	Mass.
7	Hydraulic gauge	Star Brass Manufacturing Co.	Boston	Mass.
12	Railroad rail joint	Standard Railway Rail-joint Co.	....do	Mass.
16	Steel plate	Cunningham Iron Works Co.	Charlestown	Mass.
20	Wrought-iron plate	....do	....do	Mass.
	Sash chain	Thomas Morton	New York	N. Y.
	Babbitt nut	G. W. & F. Smith Iron Co	Boston	Mass.
	Steel eastings	American Steel Car Wheel Co.	....do	Mass.
22	Brieks	W. M. Kasson	....do	Mass.
29	Steel castings	Edward Kendall & Sons	Cambridgeport	Mass.
	Wrought-iron plate	Cunningham Iron Works Co.	Charlestown	Mass.
	Steel bar	Thomson-Houston Electric Co.	Lynn	Mass.
Sept. 3	Brieks	W. M. Kasson	Boston	Mass.
4	Railway spikes	Dunham Manufacturing Co	....do	Mass.
9	Spirally wound tubes	Pneumatic Dynamite Gun Co.	New York	N. Y.
22	Brieks	Metropolitan Sewerage Com	Boston	Mass.
23	Sash chain	Thomas Morton	New York	N. Y.
	Tackle block hooks	Thos. Laughlin & Son	Portland	Me.
25	Sandstone	Andrews, Jaques & Rantoul	Boston	Mass.
Oct. 8	Bronze	The Aluminum Brass and Bronze Co.	Bridgeport	Conn.
15	Sash chain	Thomas Morton	New York	N. Y.
16	Wrought iron	Lebanon Iron Co	Lebanon	Pa.
27	Cordage	Luther W. Lee	Boston	Mass.
29	Masonry	Metropolitan Sewerage Com	....do	Mass.
30	Sash chains	Thomas Morton	New York	N. Y.
	Turn buckle	Laconia Car Co	Laconia	N. H.
	Linen lines	Luther W. Lee	Boston	Mass.
Nov. 3	Bricks	Philadelphia and Boston Face Brick Co.	....do	Mass.
	Steel plate	E. D. Leavitt	Cambridgeport	Mass.
8	....do	Wm. Allen & Sons	Worcester	Mass.
10	Steel rails	P. H. Dudley	New York	N. Y.
13	Thread and lines	A. M. White	Waterbury	Conn.
14	Trolley-wire joints	Edison General Electric Co.	Boston	Mass.
21	Manganese steel	N. Washburn	Allston	Mass.
24	Steel castings	E. D. Leavitt	Cambridgeport	Mass.
28	Steel plate	Cunningham Iron Works Co.	Charlestown	Mass.
	....do	Wm. Allen & Sons	Worcester	Mass.
Dec. 1	Manila rope	Van Slyck & Van Slyck	Providence	R. I.
6	Steel plate	Carnegie, Phipps & Co.	Pittsburg	Pa.
18	....do	Nashua Iron and Steel Co	Nashua	N. H.
	....do	Quinn & Co	Portland	Me.
	Wrought-iron plate	Hartford Steam Boiler Inspection and Insurance Co.	Hartford	Conn.
27	Locomotive driving box	South Boston Iron Works	South Boston	Mass.
	Trace chain	Bridgeport Chain Co	Bridgeport	Conn.
30	Steel plate	Prof. G. Lanza	Boston	Mass.
1891.				
Jan. 2	Riveted joints and metal.	Washburn & Moen Manufacturing Co.	Worcester	Mass.
5	Bricks	Waldo Bros	Boston	Mass.
6	Wrought-iron bars	Wason Manufacturing Co	Springfield	Mass.
7	Riveted joints and metal.	H. S. Robinson	Boston	Mass.
9	Wrought-iron plate	Geo. H. Lloyd	....do	Mass.
10	Riveted joints	H. S. Robinson	....do	Mass.
15	....do	....do	....do	Mass.
20	Chain and swivel	P. Dudley	Portland	Me.

PRIVATE TESTS—Continued.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1891.				
Jan. 23	Bricks	Waldo Bros	Boston	Mass.
24	Granite	Pigeon Hill Granite Co	Rockport	Mass.
	Fire-proof building blocks.	Corning Clay Works	St. Paul	Minn.
29	Steel plate	Wm. Allen & Sons	Worcester	Mass.
Feb. 2	Sandstone	Andrews, Jaques & Rantoul	Boston	Mass.
	Granite	Pigeon Hill Granite Co	Rockport	Mass.
9	Riveted joint and metal.	Edward Kendall & Sons	Cambridgeport	Mass.
	Steel plate	Golding & Co	Boston	Mass.
	Steel chain	Bradlee & Co	Philadelphia	Pa.
10	Jack screws	A. O. Norton	Boston	Mass.
13	Fire bricks	Newton and Watertown Gas Light Co.	Watertown	Mass.
16	Riveted joints and metal.	William Allen & Sons	Worcester	Mass.
	Camel hair belting	F. Reddaway & Co	New York	N. Y.
17	Riveted joint and metal.	Edward Kendall & Sons	Cambridgeport	Mass.
19	Steel casting	American Steel Car Wheel Co.	Boston	Mass.
21	Spring steel	Pennsylvania Railroad Co	Altoona	Pa.
24	Steel plate	Cunningham Iron Works Co	Charlestown	Mass.
	Cast iron	G. W. & F. Smith Iron Co	Boston	Mass.
25	....do	Golding & Co	....do	Mass.
	Riveted joints and metal	Edward Kendall & Sons	Cambridgeport	Mass.
	Turn buckle	Laconia Car Co	Laconia	N. H.
28	Chain cable	Bradlee & Co	Philadelphia	Pa.
	Cast iron	N. S. Bartlett & Co	Boston	Mass.
Mar. 3	Steel bars	C. P. Lovell	....do	Mass.
9	Wrought-iron plate	Boston Bridge Works	....do	Mass.
13	Railroad chain	H. J. Bettis	....do	Mass.
16	Steel casting	American Steel Car Wheel Co.	....do	Mass.
	Steel bar	Golding & Co	....do	Mass.
	Wrought-iron rods	Fuller, Dana & Fitz	....do	Mass.
18	Steel casting	American Steel Car Wheel Co.	....do	Mass.
23	Brick pier	Andrews, Jaques & Rantoul	....do	Mass.
	Sandstone	Fairhaven Sandstone Co	Fairhaven	Wash.
25	Draw-bars and malleable iron.	Wilmington Malleable Iron Co.	Wilmington	Del.
26	Chain	A. E. Stevens & Co	Portland	Me.
27	Wrought-iron strap	Dodge, Haley & Co	Boston	Mass.
Apr. 1	Steel bars	Burnham & Duggan Railway Appliance Co.	....do	Mass.
2	Steel wire	H. J. Bettis	....do	Mass.
6	Sandstone	R. M. Evans	New York	N. Y.
	Chain	A. E. Stevens & Co	Portland	Me.
15	Jack screws	A. O. Norton	Boston	Mass.
	Terra cotta	Boston Terra Cotta Co	....do	Mass.
	Granite	Norcross Bros	....do	Mass.
	Cast iron	Woonsocket Rubber Co	Woonsocket	R. I.
	Steel plate	Geo. H. Lloyd	Boston	Mass.
16	....do	Edward Kendall & Sons	Cambridgeport	Mass.
17	Steel bars	Washburn Car Wheel Co	Hartford	Conn.
24	Steel shaft	Henry M. Howe	Boston	Mass.
29	Chain	A. E. Stevens & Co	Portland	Me.
30	Jack screw	A. O. Norton	Boston	Mass.
May 2	Copper wire	Chas. R. Fletcher	....do	Mass.
4	Columns, steel	Jones & Laughlin	Chicago	Ill.
5	Locomotive side rods	Houghton & Richards	Boston	Mass.
	Steel casting	American Steel Car Wheel Co.	South Boston	Mass.
6	Steel bars	C. P. Lovell	Boston	Mass.
7	....do	Washburn Car Wheel Co	Worcester	Mass.
9	Steel plates	Edward Kendall & Sons	Cambridgeport	Mass.
15	....do	Cunningham Iron Works Co	Charlestown	Mass.
	Locomotive side-rods	Houghton & Richards	Boston	Mass.
16	Bricks	Fiske & Coleman	....do	Mass.
	....do	Metropolitan Sewerage Com	....do	Mass.
19	Insulators and pull-offs.	Gould & Watson	....do	Mass.
20	Steel plate	Edward Kendall & Sons	Cambridgeport	Mass.
21	Terra cotta	Boston Terra Cotta Co	Boston	Mass.
25	Bricks	Fiske, Coleman & Co	....do	Mass.
26	Helical springs	Prof. J. B. Johnson	St. Louis	Mo.
June 1	Steel plates	Geo. H. Barrus	Boston	Mass.
4	Artificial granite	Keene Granite Terra Cotta and Tile Co.	Keene	N. H.
5	Granite	Alex. McDonald & Son	Cambridge	Mass.
6	Wrought-iron rods	Riehle Bros	Philadelphia	Pa.
8	Steel plates	Edward Kendall & Sons	Cambridgeport	Mass.

PRIVATE TESTS—Continued.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1891.				
June 8	Iron	Granger Foundry and Machine Co.	Providence	R. I.
13	Steel columns	Carnegie, Phipps & Co	Pittsburg	Pa.
16	Steel plates	Edward Kendall & Sons	Cambridgeport	Mass.
17	....do	Cunningham Iron Works Co	Charlestown	Mass.
	....do	Stone, Carpenter & Willson	Providence	R. I.
18	Cotton duck	J. H. Lane	Boston	Mass.
	Granite	Braintree Granite Co	....do	Mass.
23	Steel plates	Lowell Water Board	Lowell	Mass.
24	Steel bar	I. P. Morris Co	Philadelphia	Pa.
25	Cast iron	A. W. Rounds	Boston	Mass.
	Insulated pull-off	Gould & Watson Co	....do	Mass.
	Wrought-iron bars	Houghton & Richards	....do	Mass.
27	Steel rails	P. H. Dudley	New York	N. Y.
29	Steel plate	Edward Kendall & Sons	Cambridgeport	Mass.
30	Riveted joints	Camden Iron Works	Camden	N. J.

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